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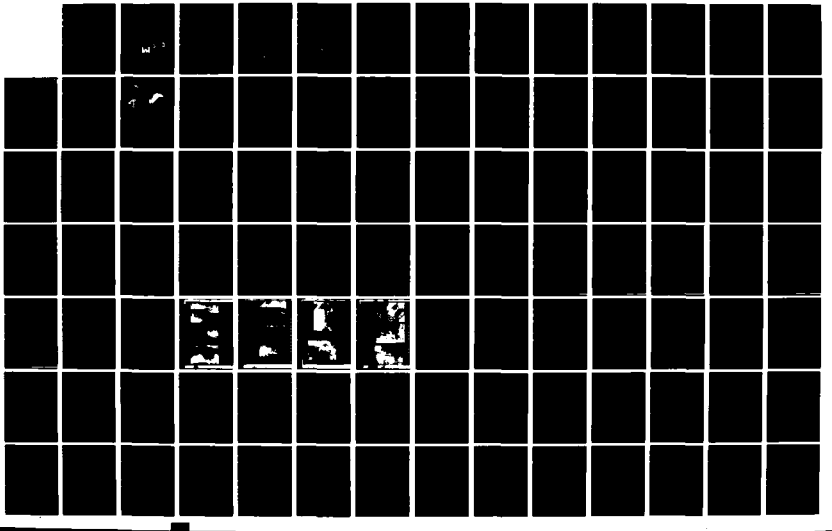

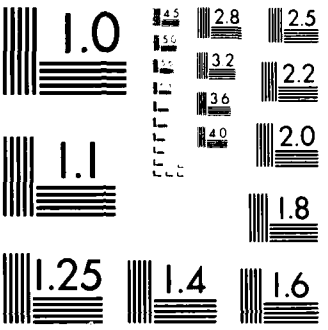

FARMINGTON RIVER BASIN
TOLLAND, MASSACHUSETTS

LOST WILDERNESS LAKE
SOUTHERN DAM (TWINING POND DAM)
MA 00321

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DECEMBER 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Farmington River Basin
Tolland, Massachusetts
Tributary of West Branch Farmington River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earthen embankment 440 ft. long and 27 ft. high with a drop inlet principal spillway structure and a 36 inch outlet conduit. The dams are intermediate in size. The Twining Pond dam is a significant hazard classification and the Northern Dam is a low hazard classification. The dam is generally in good condition. There are a few remedial measures to be undertaken by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

DEC 9 1980

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

Inclosed is a copy of the Lost Wilderness Lake Southern Dam (MA-00321) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely,

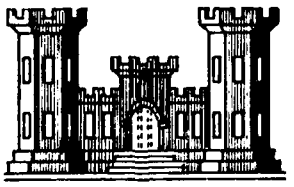
WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

Incl
As stated

FARMINGTON RIVER BASIN
TOLLAND, MASSACHUSETTS

LOST WILDERNESS LAKE
SOUTHERN DAM (TWINING POND DAM)
MA 00321

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DECEMBER 1979

LOST WILDERNESS LAKE
SOUTHERN DAM (TWINING POND DAM)
MA 00321

WEST BRANCH OF THE FARMINGTON RIVER BASIN
TOLLAND, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Indentification No.:	MA 00321
Mass. D.P.W. No.	1-7-297-3
Name of Dam:	Lost Wilderness Lake - Southern Dam (Twining Pond Dam)
Town:	Tolland
County and State:	Hampden County, Massachusetts
Stream:	Tributary of West Branch Farmington River
Date of Inspection:	October 31, 1979

BRIEF ASSESSMENT

The Twining Pond dam is located at the southwest corner of Lost Wilderness Lake (formerly Twining Pond) which is approximately 2.5 miles west of Tolland Center in Tolland, Massachusetts. A second dam, Northern Dam (MA 01059) was also constructed to form Lost Wilderness Lake. The dam was constructed as part of a recreational community and land development project. The dam is an earthen embankment 440 feet long and 27 feet high with a drop inlet principal spillway structure and a 36-inch outlet conduit. The emergency spillway is located to the right of the embankment and is 170 feet wide at the control section. There is also an earthen dike approximately 90 feet long and 4 feet high. This dike is located to the right of the emergency spillway.

The owner of the land on which the dam is located is Francis Deming, West Tolland, Massachusetts. The Owner of the dam is Lost Wilderness, Inc. which is currently being managed by the Woronoco Savings Bank of Westfield, Massachusetts.

The drainage area affecting the Lost Wilderness Lake Dams is approximately 1.22 square miles and is comprised of heavily wooded rolling terrain. The dam impounds approximately 1200 acre feet at the normal pool elevation of 1349 feet MSL and 2000 acre feet at the top of the dam elevation of 1,355.5 feet MSL. The Twining Pond and Northern dams are INTERMEDIATE in size. The Twining Pond dam is a SIGNIFICANT hazard classification, and the Northern dam is a LOW hazard classification.

The test flood for this dam is one-half of the Probable Maximum Flood (½ PMF). For this drainage area the ½ PMF is 1,390 cfs. When this flood is routed through the reservoir, the resulting outflow is 960 cfs. The spillways of both the Twining Pond Dam and the Northern Dam would be used to relieve the test flood since both spillways are indicated to be at the same elevation. The combined emergency spillway capacity is 5,140 cfs. The elevation of the spillways was determined from construction drawings; no field levels were made to check elevations. The spillway test flood outflow would be about 800 cfs from the Twining Pond dam and 160 cfs from the Northern dam. The depth in the spillways would be approximately 1.3 feet with a freeboard of 3.2 feet remaining to the top of the dam.

Failure of the Twining Pond dam will severely damage two roadway crossings and one house with attendant probable loss of a few lives. In addition, three homes and two roadway crossings will incur minor flooding damage.

The dam is generally in good condition, however, the stilling basin shown on the design plans has never been constructed and there are two other areas which warrant further investigation. The source of the wetness along the toe of the left downstream embankment of the dam should be determined. Likewise the source of the wet condition at the toe of the downstream embankment of the emergency spillway should be investigated. The dam is, therefore, assessed to be in FAIR condition.

Remedial measures to be undertaken by the owner include: clarification of ownership and responsibility for operation and maintenance.

The recommendations and the remedial measures outlined above should be implemented within one year of receipt of this report by the Owner.

John W. Powers
Massachusetts Registration 23106

This Phase I Inspection Report on Lost Wilderness Lake/Southern Dam (MA00321) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspecton, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

TABLE OF CONTENTS

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) General

The Twining Pond Dam at Lost Wilderness Lake (Dam No. MA 321) is in good condition, however, the outlet conduit, toe drains, and plunge pool are in fair condition at the present time.

(b) Dam

1) Earth Embankment (See photos 1, 2 & 11)

The upstream slope is protected by riprap and is in good condition. There is debris on the upstream slope, but there was no evidence of erosion or animal burrows along the upstream slope.

The two toe drains were flowing at a few gallons per minute with the discharge from both being clear. (See photos 9 & 10.) The stilling basin and headwall were never constructed and consequently, the toe drains are discharging on the downstream slope of the embankment. This area has tall grass which is starting to overgrow and could eventually clog both toe drains.

There is some minor erosion on the downstream slope and some low spots (approximately 4 to 6 inches deep) along the crest of the embankment. The left toe of the downstream slope is wet and spongy. (See photo 11.)

2) Emergency Spillway (See photos 4 & 5)

The emergency spillway is in relatively good condition. Some debris is deposited in the entrance and approach channel and the channel side slope has a ledge outcrop. There are tire marks on the downstream slope which have caused erosion. (See Photos 4 & 5.) The toe of the spillway discharge slope is wet and spongy. The area directly downstream of the emergency spillway is gently sloping and thickly wooded.

(c) Appurtenant Structure

1) Drop Inlet Principal Spillway Structure (See photos 1 & 3)

The structure is in good condition with no evidence of spalling, cracking, or efflorescence. The sluice gate bench stand is in good condition however, two base plate nuts were missing. The hand wheel has been removed from the site to prevent unauthorized use. The trash racks are in good condition and are free of debris.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

Some design data, including hydrologic computations for the watershed and hydraulic computations for the Twining Pond Dam, as well as some soils testing at both sites, some seepage calculations and reinforced concrete structural design computations were available for review at the offices of Robert G. Brown and Associates, Inc., Pittsfield, Massachusetts.

2.2 Construction Data

The design plans available for this dam show good agreement with the visual inspection. The only exception is that the stilling basin downstream of the outlet conduit was never constructed.

Construction data was not made available for our review.

2.3 Operation Data

Since the dam is self regulating, there is no operational data available.

2.4 Evaluation of Data

The hydraulic and hydrologic design data was not sufficient to satisfy the requirements of the Corps of Engineers "Recommended Guidelines." Therefore, hydraulic and hydrologic calculations were carried out as part of this Phase I Investigation and are discussed in Section 5 and detailed in Appendix D.

Seepage and stability analyses comparable to the requirements of paragraph 4.4 of the "Recommended Guidelines" were not available for review. However, since the dam is INTERMEDIATE in size and SIGNIFICANT in hazard classification, and since our visual inspection showed the dam to be in generally GOOD condition such analyses are not considered necessary at this time (Ref. Par. 3.6.1 of "Recommended Guidelines.")

4) Control Mechanism: 18-inch wheel operated sluice gate at invert elevation of 1,334.0 feet MSL for pond drainage. Flow to 36-inch pipe normally overflows the two rectangular weirs in the riser structure.

Gate data: Rodney Hunt Model S-5002

(h) Diversion and Regulating Tunnel

Not applicable

(i) Spillway

1) Type:

a) Principal spillway: Reinforced concrete drop inlet

b) Emergency Spillway: Grass covered, earth cut and fill channel with level control section.

2) Length of weir:

a)	Pond drain inlet:	18 inch diameter pipe
b)	Principal spillway:	2 @ 5 feet = 10 feet
c)	Emergency spillway:	170 feet

3) Crest elevation:

a)	Pond drain inlet:	1,334.0 inv.
b)	Principal spillway inlet:	1,349.0
c)	Emergency spillway:	1,351.0

4) Gates: 18 inch diameter sluice gate on pond drain inlet.

5) Upstream Channel:

a)	Principal spillway:	Reservoir
b)	Emergency spillway:	Grass covered earth cut and fill channel 50± ft. to control section.

6) Downstream Channel:

a)	Principal spillway:	Unlined plunge pool and narrow channel through gently sloping wooded land.
b)	Emergency spillway:	Grass covered, earth cut and fill channel 250± ft. to wooded area discharging into natural stream channel 300± ft. downstream of dam.

(j) Regulating Outlets

1) Invert: 1,333.0 feet MSL

2) Size: 36-inch

3) Description: 136 feet of 36" reinforced concrete water pipe

4) Top of dam: 3,500±

5) Test flood pool: 3,400±

(e) Storage (acre-feet)

1) Normal pool: 1,200±

2) Full flood control pool: Not applicable.

3) Emergency spillway crest pool: 1,400±

4) Top of dam: 2,000±

5) Test flood pool: 1,600±

(f) Reservoir Surface (acres)

1) Normal pool: 100

2) Full flood control pool: Not applicable.

3) Spillway crest: 116

4) Test flood pool: 130

5) Top of dam: 150

(g)	Dam	Dike
1)	Type: Earth Embankment	Earth Embankment
2)	Length: 440 ft.	90 ft.
3)	Height: 27 ft.	4 ft.
4)	Top Width: 15 ft.	15 ft.
5)	Side Slopes: Upstream 3 to 1 Downstream 3 to 1	
6)	Zoning: More Pervious Soil Borrow (Gravel or sand borrow - GP, GW, SP or SW)	Same
7)	Impervious Core: More Impervious Soil Borrow (SM or GM)	Same
8)	Cutoff: More Impervious Soil Borrow (SM or GM)	Unknown
9)	Grout curtain: None	None

6) Gated Spillway Capacity at Test Flood Elevation

There are no gated spillways.

7) Total Spillway Capacity at Test Flood Elevation

The total spillway capacity for this dam at test flood elevation (1,352.3 feet MSL-NGVD) is approximately 800 cfs. (Northern dam spillway capacity is approximately 160 cfs for a combined capacity of 960 cfs.)

8) Total Project Discharge at Top of Dam

The total project discharge at top of dam (1,355.5 feet MSL-NGVD) is approximately 4,384 cfs (Northern dam discharge is approximately 756 cfs for combined discharge of 5,140 cfs).

9) Total Project Discharge at Test Flood Elevation

The total project discharge at test flood elevation (1,352.3 feet MSL-NGVD) is approximately 800 cfs. (Northern dam discharge is approximately 160 cfs for a combined discharge of 960 cfs.)

(c) Elevation (ft. above MSL-NGVD)

1) Streambed at toe of dam: 1,328.5

2) Bottom of cutoff: 1,326

3) Maximum tailwater: unknown

4) Normal pool: 1,349.0

5) Full flood control pool: Not applicable.

6) Emergency spillway crest (No gates): 1,351.0 (at both dams)

7) Design surcharge (Original Design): unknown

8) Top of dam: 1,355.5 (Both dams)

9) Test flood design surcharge: 1,352.8

(d) Reservoir (Length in feet)

1) Normal pool: 3,300±

2) Full flood control pool: Not applicable.

3) Emergency spillway crest pool: 3,360±

(i) Normal Operating Procedure

The dam is normally self regulating. The pond drain gate is normally closed and was operated once to close only after vandals had forced it open.

1.3 Pertinent Data

(a) Drainage Area

The drainage area for this dam covers approximately 1.22 square miles. It is made up primarily of rolling hills with a small section of fresh water marsh. The hills are wooded with some pasture and minor development.

(b) Discharge at Damsite

1) Outlet Works

Normal discharge at the site is via the inlets at elevation 1,349.0 to the principal spillway and through the 36 inch diameter outlet pipe to the downstream channel. In the event of severe flood flows, excess flow would discharge over the emergency spillway at elevation 1351.0 feet (MSL). The test flood would flow through the spillway facilities at both the Twining Pond Dam and the Northern Dam. (See calculations in Appendix D.)

2) Maximum Known Flood at Damsite

There is no data available for the maximum known flood at this damsite.

3) Ungated Spillway Capacity at Top of Dam

The capacity of the principal spillway with the reservoir at top of dam elevation (1355.5 feet MSL-NGVD) is approximately 165 cfs. The capacity of the emergency spillway is approximately 4,200 cfs at this level.

4) Ungated Spillway Capacity at Test Flood

The capacity of the principal spillway with the reservoir at test flood elevation (1,352.3 feet MSL-NGVD) is approximately 165 cfs. The capacity of the emergency spillway is approximately 635 cfs at this level.

5) Gated Spillway Capacity at Normal Pool Elevation

There are no gated spillways with the exception of the gated pond drain inlet which is normally closed.

(c) Size Classification

The maximum impoundment for both dams is approximately 2,000 acre feet with the pond elevation at the top of the dam. The height of the Southern dam is 27 feet from the original downstream toe stream channel to the top of the dam. The dam is, therefore, in the INTERMEDIATE size category according to the Corps of Engineers' Recommended Guidelines.

(d) Hazard Classification

The hazard potential classification for the Southern dam is SIGNIFICANT because of the economic losses and potential for loss of life downstream which may occur in the event of dam failure. There is a high potential for severe damage to one house with attendant probable loss of a few lives, as well as two roadway crossings. In addition, three houses and two roadway crossings may incur minor flooding damage. Section 5 of this report presents more detailed discussion of the hazard potential.

(e) Ownership

The land on which the dam was built is owned by Mr. Francis Deming of West Tolland, Massachusetts. He can be reached by telephone at 413-258-4717. The owner of the subdivision and the party who had the dam designed and constructed is Lost Wilderness, Inc.. The Woronoco Savings Bank in Westfield, Massachusetts is handling all the affairs of the subdivision as of this writing (Dec. 1979). Inquiries should be made to Mr. Mahoney at the Woronoco Savings Bank by telephone at 413-568-9141.

(f) Operator

Neither the Woronoco Savings Bank nor Mr. Francis Deming assume responsibility for the operation of the dam. Mr. Deming has possession of the wheel for the sluice gate and has closed the gate after vandals had forced it open. However, nobody has performed regular operation and maintenance on this dam.

(g) Purpose of the Dam

The purpose of the dam is recreational. Lost Wilderness Lake was designed to be the center of a recreational community. The area was subdivided and some property has been sold. However, very little of the surrounding area has been developed.

(h) Design and Construction History

The dam was designed by Brown, Moynihan & Associates, Inc. of Lee, Massachusetts and construction was completed in 1976. The stilling basin was never constructed.

At the base of the structure there is an 18 inch diameter, vertical lift sluice gate inlet which is controlled by a wheel operated bench stand with a rising stem. An 18 inch diameter reinforced concrete pipe extends 16 feet upstream from the lift gate into the impoundment pool. Plans indicate a reinforced concrete inlet structure at the upstream end of this pipe which is protected by a trash rack of steel reinforcing bars bent in a "C" shape across the opening.

The "low stage inlet" is comprised of two uncontrolled openings approximately 15 feet above the sluice gate invert. They are both two feet high and 10 feet long and are located in the sides of the riser structure. The water flows over these weirs and drops into the riser structure. They are protected by trash rack assemblies approximately 3 feet high and 11 feet wide. This assembly is fabricated from galvanized steel angle sections and steel reinforcing bars.

There are no high stage inlets on this structure.

The riser structure is drained by a 36-inch diameter reinforced concrete pressure pipe. It is approximately 136 feet long and drops approximately 4.0 feet over that length. The pipe penetrates the downstream side of the riser structure and is supported by a 9 inch thick concrete cradle within the embankment. Plans indicate 3 concrete anti-seep collars cast around the pipe within the embankment.

The downstream end of the conduit and cradle extend approximately 10 feet downstream of the embankment. The cradle is supported by a reinforced concrete tee bent. The top flange of this bent is 12 inches thick, 10 inches deep, and 8 feet wide. The discharge conduit outlets into an unfinished plunge pool. The plans call for a stilling basin, which has not been constructed.

3) Emergency Spillway (See pages B-1 & B-2)

The emergency spillway was excavated approximately 200' right of the dam and is 170 feet wide at the control section. The spillway is approximately 400 feet long and its control section is approximately 4.5 feet below the crest of the dam. The side slopes are 3 horizontal to 1 vertical.

4) Foundation and Embankment Drainage

Two, three foot wide trench drains of clean sand and gravel extend almost the full length of the downstream embankment. Each trench drain includes a 4 inch perforated asbestos cement pipe. One extends 117 feet to the left of the outlet conduit, and the other extends 39 feet to the right of the outlet conduit. These pipes discharge on either side of the outlet conduit.

2.5 miles west of Tolland Center in Tolland, Massachusetts. It can be reached from East Otis Road which intersects State Route 57 approximately 1 mile east of the center of New Boston. The dam is shown on the U.S.G.S. Tolland Center Quadrangle which covers portions of Massachusetts and Connecticut. The dam is located at approximately N42°-05'-45" latitude and W73°-03'-30" longitude (see Locus Plans 1 and 2). Page B-1 of Appendix B is a site plan for this dam. Twining Pond Dam is one of two dams impounding water which create Lost Wilderness Lake; the other dam is the Northern dam (MA 01059).

(b) Description of Dam and Appurtenances

The dam consists of an earth embankment, a principal spillway with a reinforced concrete riser and outlet pipe, and an emergency spillway located approximately 200 feet from the right abutment of the dam. The length of the embankment is 440 feet. The separate emergency spillway is 170 feet wide at the control section.

1) Embankment (See pages B-1 & B-2)

The embankment is made up primarily of silty fine sand (designation SM or GM using the Unified Soil Classification System). It is 440 feet long and is a maximum of 27 feet high. The upstream slope is 3 horizontal to 1 vertical; the downstream slope is 3 horizontal to 1 vertical; and the width of the top of the dam is 15 feet.

Beneath the embankment is an earthfill cutoff trench approximately 12 feet in width at the bottom. According to available plans, it is constructed of the same silty fine sand material as the embankment. The cutoff trench was designed and constructed to extend through sand and gravel layers to firm bedrock or glacial till.

Riprap approximately 30 feet wide over the entire length of the upper portion of the upstream slope provides erosion protection. The riprap is machine placed, 1' to 2' diameter stone.

2) Principal Spillway

The principal spillway consists of a reinforced concrete drop inlet structure with a sluice gate controlled inlet pipe and two uncontrolled orifice inlets and an outlet pipe which is supported on a concrete cradle.

The riser structure is 19.8 feet high and 12 feet wide normal to the axis of the dam. It is 5 feet long parallel to the embankment for the bottom 12 feet and flares to 12 feet long at the top. The walls and the base slab of the structure are 12 inches thick. The top slab is 10 inches thick.

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

LOST WILDERNESS LAKE - TWINING POND DAM

NO. MA 00321

SECTION 1

PROJECT INFORMATION

1.1 General

(a) Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Tighe & Bond/SCI has been retained by the New England Division to inspect and report on selected dams in Massachusetts. Authorization and notice to proceed were issued to Tighe & Bond/SCI under a letter of October 24, 1979 from Colonel Willia, E. Hodgson, Jr., Corps of Engineers. Contract No. DACW-33-80-C-0005 has been assigned by the Corps of Engineers for this work.

(b) Purpose

1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-federal dams.

3) Update, verify, and complete the National Inventory of Dams.

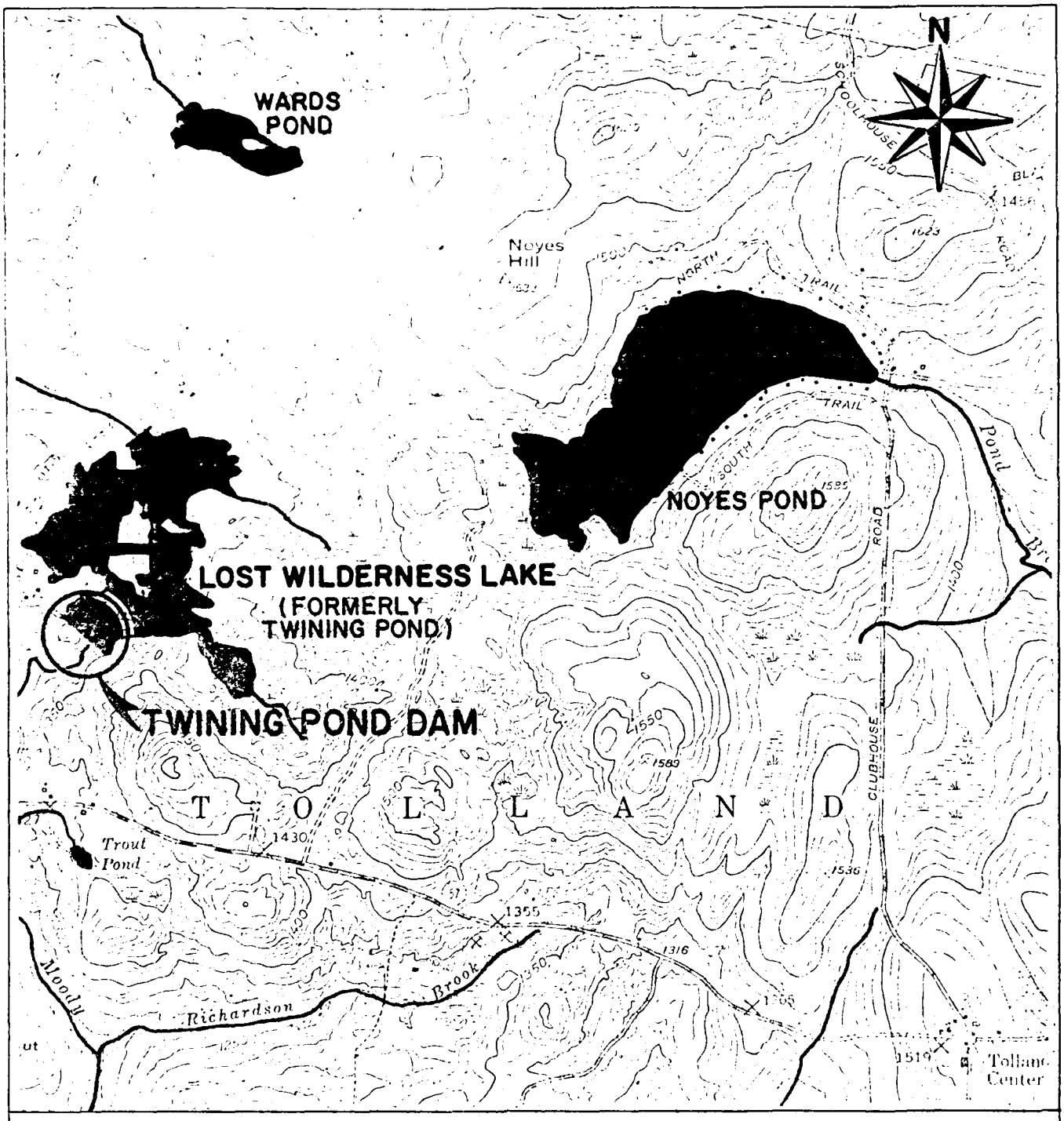
(c) Scope

The program provides for the inspection of non-federal dams in the high hazard potential category based upon location of the dams and those dams in the significant hazard potential category believed to represent an immediate danger based on condition of the dams.

1.2 Description of Project

(a) Location

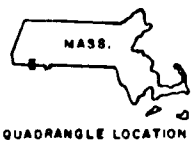
The Twining Pond Dam is located at the southwest corner of Lost Wilderness Lake (formerly Twining Pond) which is approximately



- SCALE -

1000' 0 1000' 2000' 3000'

FROM: U.S.G.S. TOLLAND CENTER, MASS.-CONN. QUADRANGLE MAP



QUADRANGLE LOCATION

TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

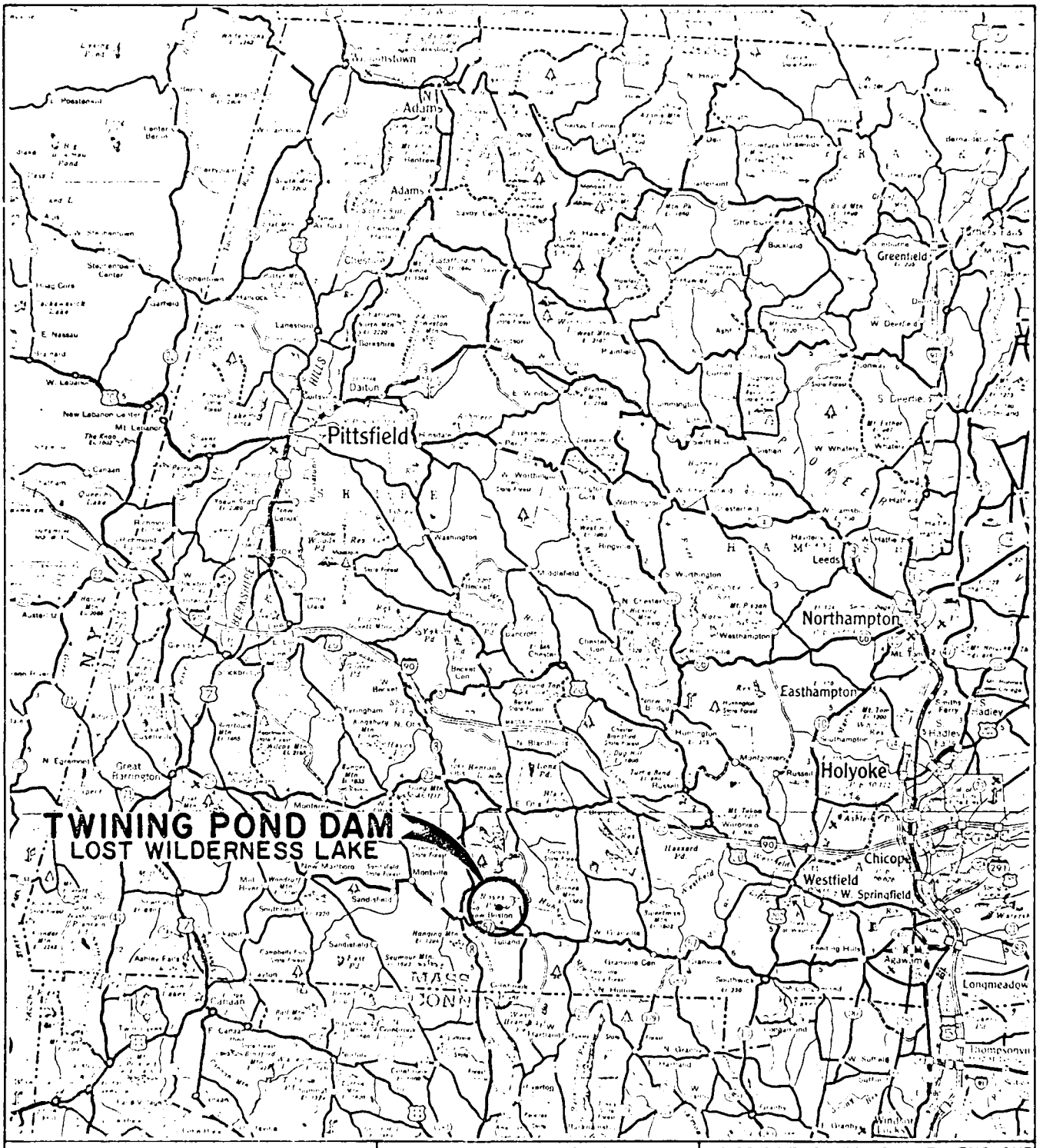
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN 2

SOUTHERN DAM (TWINING POND DAM) MA 00321
LOST WILDERNESS LAKE
HAMPDEN COUNTY

TOLLAND
MASSACHUSETTS

			SCALE: AS NOTED
			DATE: DECEMBER 1979



TIGHE & BOND / SCI
CONSULTING ENGINEERS
EASTHAMPTON, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

5 0 5 10
SCALE IN MILES

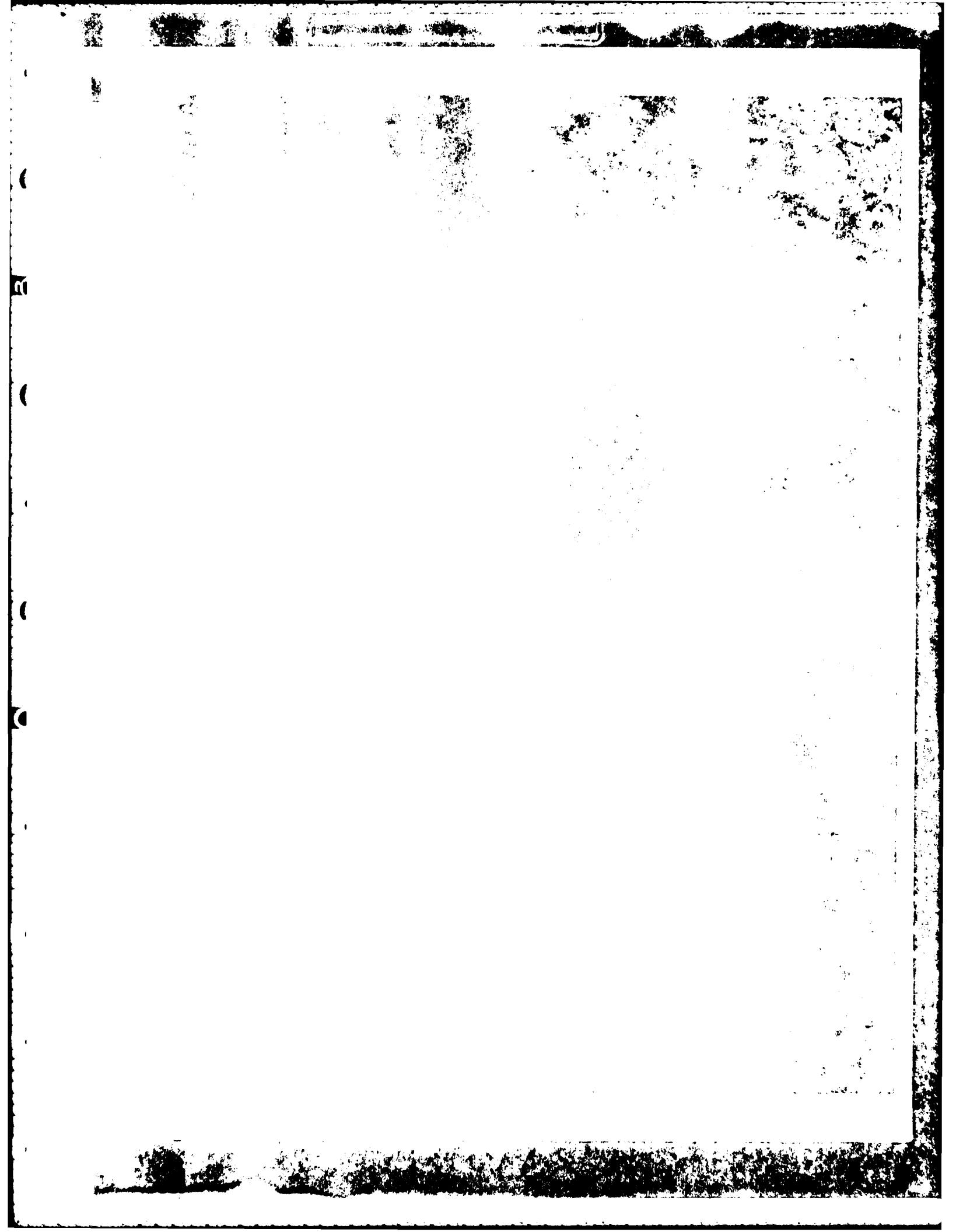
MASS.
MAP LOCATION

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN I

SOUTHERN DAM (TWINING POND DAM) MA 00321
LOST WILDERNESS LAKE — TOLLAND
HAMPDEN COUNTY — MASSACHUSETTS

			SCALE: AS NOTED
			DATE: DECEMBER 1979



2) Pond Drain Inlet Pipe

At the time of inspection the 18-inch pond drain inlet pipe was completely submerged and could not be observed.

3) Outlet Conduit (See photos 6, 7 & 8)

The downstream end of the outlet pipe shows spalling on the outside top of the pipe. The alignment was good and all interior joints were dry above the flow line. The interior of the conduit is in good condition with no visible spalling, cracking or efflorescence. The tee bent is completely below ground and therefore not exposed to inspection.

(d) Reservoir Area

The shore of the reservoir is generally shallow sloping woodland. It appears stable and in good condition. However, there is some debris along the riprap at the face of the embankment and along the entrance to the emergency spillway.

(e) Downstream Channel (See photo 6)

The downstream channel is a narrow channel passing through gently sloping woodland. The channel appears stable and in good condition. The stilling basin was never constructed and the existing plunge pool is not completely protected by riprap.

3.2 Evaluation

The dam is generally in good condition. The outlet conduit due to the lack of a stilling basin is in fair condition. The potential problems noted during the visual inspection are listed below.

a) Wet, spongy condition along the left downstream toe of the embankment.

b) Erosion and tire marks on the downstream slope of the embankment and the emergency spillway.

c) Debris on the upstream embankment slope and in the emergency spillway entrance.

d) Spalling of downstream end of outlet conduit.

e) The stilling basin shown on the plans has not been built and the existing plunge pool is not protected by riprap.

f) Wet, spongy condition along the toe of the downstream slope of the emergency spillway.

g) The small depression (4"-6") on the crest of the embankment near the principal spillway.

h) There is a depression about one foot deep on the crest of the dike.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

(a) General

No written operational procedures are available for this dam. The dam is self regulating.

(b) Description of Any Warning System in Effect

There is no written warning system in effect.

4.2 Maintenance Prodecures

(a) General

No maintenance has been done on this dam since it was constructed.

(b) Operating Facilities

Operation of the sluice gate for the pond drain is the only mechanical item that must be exercised on a regular basis. At this time, no individual or agency is performing this operation. The gate was opened by vandals last year and was closed shortly thereafter by Mr. Deming, the owner of the land on which the dam was constructed.

4.3 Evaluation

Detailed operating procedures are not considered necessary since the dam is self regulating.

A program of annual technical inspection should be established and regular maintenance should be carried out.

Most importantly, responsibility for operation and maintenance must be clarified.

A downstream emergency flood warning system should be developed.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The Twining Pond Dam at Lost Wilderness Lake is in the watershed of the West Branch of the Farmington River. The dam is located approximately 1.5 miles upstream of the confluence of an unnamed brook and the West Branch of the Farmington River. The upstream drainage area is approximately 1.22 square miles with rolling topography.

The dam itself is a 440 foot long earthen embankment with a grass-lined earth emergency spillway, 170 feet wide. The principal spillway consists of two orifices located on a concrete riser in the reservoir. Flow from the orifices proceeds under the dam through a reinforced concrete pipe.

5.2 Design Data

The design data made available for this review was insufficient to determine all hydraulic and hydrologic features of the Twining Pond Dam. The dam was designed by Brown, Moynihan & Associates, Inc. and their design plans show the elevation of the normal pool to be at 1,349.0 feet MSL. The emergency spillway crest was set at 1,351.0 feet MSL and the top of the dam was set at 1,355.5 feet MSL.

5.3 Experience Data

No records of flow or stage are known to be available for the Twining Pond Dam No MA 00321.

5.4 Test Flood Analysis

The hydrologic conditions of interest in this Phase I investigation are those required to assess the dam's overtopping potential and its ability to safely allow an appropriately large flood to pass. This requires using the discharge and storage characteristics of the structure to evaluate the impact of an appropriately sized Test Flood. The original hydraulic and hydrologic design calculations have not been made available for inclusion in this Report.

Guidelines for establishing a recommended Test Flood based on the size and hazard classification of a dam are specified in the "Recommended Guidelines" of the Corps of Engineers. The impoundment of between 1,000 and 50,000 acre feet and the height of less than 100 feet classify this dam as an INTERMEDIATE size structure.

The appropriate hazard classification for this dam is SIGNIFICANT because of the economic losses and potential for loss of life downstream in the event of dam failure. As shown in the Dam Failure Analysis section, the increase in flooding caused by failure would pose a threat to life and property at various locations along the brook. Other impacts of dam failure include possible damage to several small roads, and to a heavily travelled road. (See Dam Failure Analysis section.)

As shown in Table 3 of the Corps of Engineers' "Recommended Guidelines," the appropriate Test Flood for a dam classified as INTERMEDIATE in size with a SIGNIFICANT hazard potential would be one half the probable maximum flood (1/2 PMF). The Corps of Engineers' "Maximum Probable Peak Flow Rates" curve assuming rolling topography gives a PMF of 2,280 cfs/sq. mile for a drainage area of 1.22 square miles. The probable maximum flood is 2,780 cfs for this drainage area and one half the probable maximum flood is 1,390 cfs.

When this flood is routed through the reservoir, the resultant outflow from the combined spillways is 960 cfs. The spillways of both the Twining Pond Dam and the Northern Dam would be available to discharge the test flood. The Southern dam spillway will discharge approximately 800 cfs and the Northern dam spillway will discharge about 160 cfs of the routed test flood. The depth of flow at the control section of the spillways at the test flood conditions would be approximately 1.3 feet. Therefore, the existing spillway capacity can accommodate one half the Probable Maximum Flood with a freeboard of 3.2 feet remaining to the top of the dam.

5.5 Dam Failure Analysis

A dam failure analysis using the procedures in the Corps of Engineers, "Rule of Thumb Guidance for Estimating Downstream Failure Hydrographs" dated April 1978, was performed for the Lake Wilderness Southern Dam (Twining Pond Dam).

For an assumed breech equal to 40% of the dam length computed at half height, the breeched length is 64 feet. The resulting dam failure flow using a water height of 23.8 feet is 12,500 CFS. 23.8 feet represents the depth of the water upstream of the dam calculated at the test flood pond elevation. The test flood spillway outflow is 800 cfs. The Northern dam will simultaneously discharge approximately 160 cfs for a combined spillway outlfow of 960 cfs.

The first damage area impacted by dam failure flow is directly downstream of the dam. Prior to dam breech, the test flood flow is 800 CFS resulting in a river stage of about 1.8 feet. After the dam failure, the flow is 12,500 CFS resulting in a river stage of approximately 8.1 feet. There are no structures or developed areas directly downstream of the dam, therefore, the damage incurred with not be significant.

The second damage area impacted by dam failure flow is the crossing of East Otis Road which is approximately 1,500 feet downstream of the dam. Prior to dam breech, the test flood flow is 800 CFS which will exceed the capacity of the culvert and result in overtopping of the roadway by approximately 1.9 feet. The dam failure attenuated flow is 12,300 CFS and will result in overtopping of the roadway by approximately 4.6 feet. There are no structures located in this area, therefore, the damage incurred is limited to the roadway culvert crossing and post failure flows will significantly increase the potential for such damage.

The third area impacted by dam failure flow is the crossing of Route 57 approximately 3,700 feet downstream of the dam. Prior to dam breech, the test flood flow is 800 CFS which exceeds the capacity of the culvert and will result in overtopping of the roadway by approximately 1.8 feet. There is one house at this location which is about 8 feet above the stream channel. Pre-failure flooding will result in a river stage of approximately 8.3 feet, therefore, only minor flooding of this house is expected. The dam failure attenuated flow is 12,000 CFS resulting in overtopping of the roadway by approximately 4.6 feet, and a resulting river stage of approximately 11.1 feet. This will increase the flooding of the house to about 3 feet in depth and significantly increase the potential for serious damage.

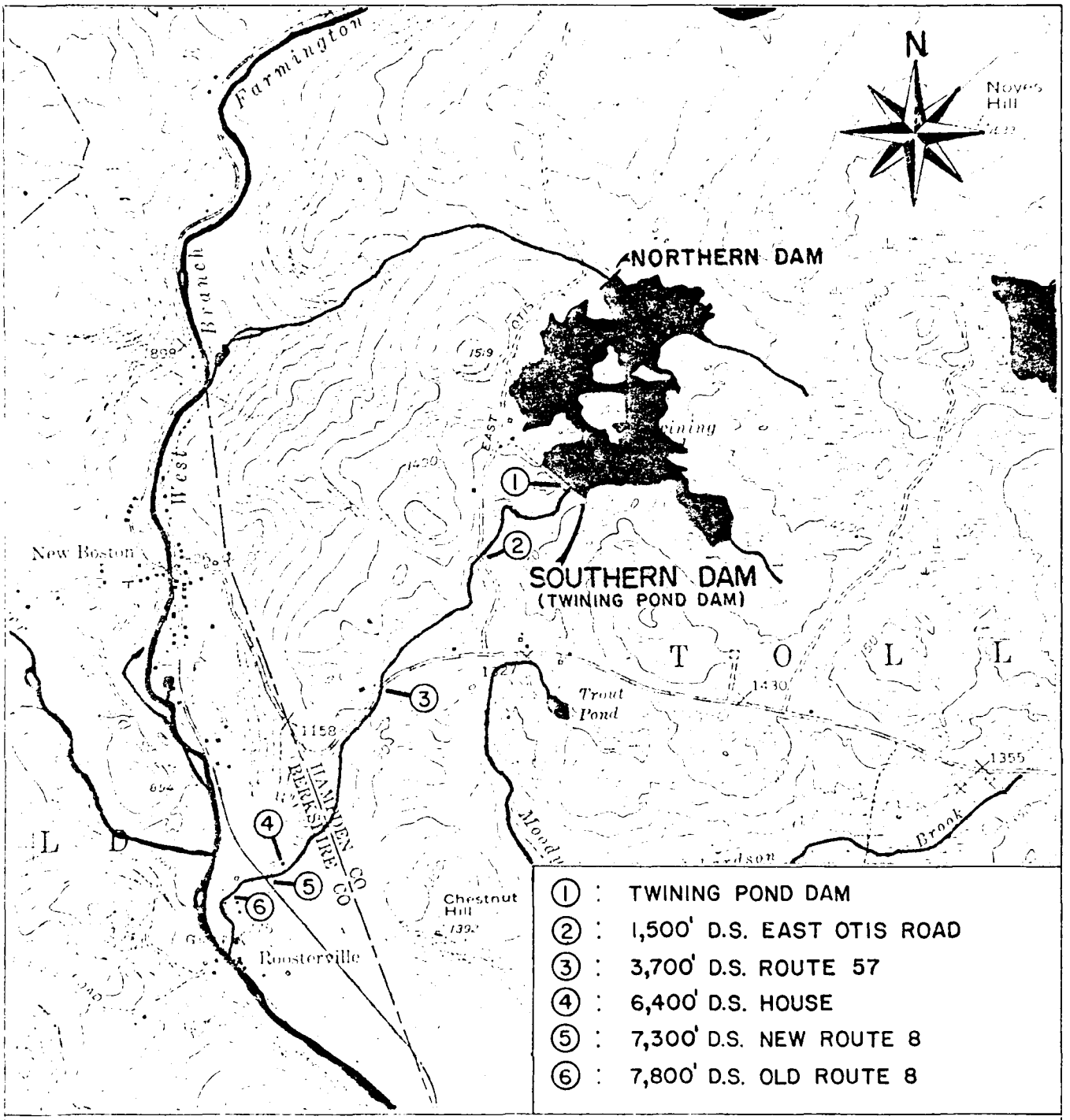
The fourth damage area impacted by dam failure flow is the location of one single family house which is approximately 6,400 feet downstream of the dam. This house is approximately 5 feet above the stream channel. Prior to dam breech, the test flood flow is 800 CFS resulting in a river stage of approximately 1.0 feet. This will not threaten the house at this location. The dam failure attenuated flow is 11,900 CFS resulting in a river stage of approximately 5.9 feet. This will result in minor flooding of the house, but will not add significantly to the potential for serious damage to the structure.

The fifth damage area impacted by dam failure flow is the crossing of newly constructed Route 8 approximately 7,300 feet downstream of the dam. The pre-failure test flood flow is 800 CFS which can be adequately handled by the box culvert, therefore, the roadway will not be overtopped and no damage is expected. The dam failure attenuated flow is 11,800 CFS which will exceed the capacity of the culvert and result in the roadway being overtopped by approximately 2.5 feet. There are no houses in the immediate vicinity of the culvert, therefore, the damage is limited to the roadway embankment.

The sixth damage area impacted by dam failure flow is the crossing of the old Route 8, which is approximately 7,800 feet downstream of the dam. There are three houses at this location which are assumed to be approximately 1 foot higher than the roadway elevation. Prior to dam breech, the test flood flow is 800 CFS which will exceed the capacity of the culvert and result in overtopping the roadway by approximately 0.3 feet. This in not expected to cause significant flooding of the houses. The dam failure attenuated flow is 11,800 CFS which results in the overtopping of the roadway by approximately 1.9 feet and will cause minor flooding of the three houses. At this location, some property damage can be expected. However, serious damage to the structures is not considered to have a high potential.

Downstream of the confluence with the West Branch of the Farmington River, the dam failure flow will be quickly attenuated by the broad flood plain area and no additional structures are threatened. Approximately 28,000 feet downstream of the confluence, there is a flood control dam across the River which will completely dampen the Lost Wilderness Dam failure flow.

In summary, the dam failure flow has a high potential for severely damaging one house with attendant probable loss of a few lives, as well as damaging two roadway crossings. In addition, three homes and two roadway crossings will probably incur only minor flooding damage. Downstream of the confluence with the West Branch of the Farmington River, the effects of a dam failure are negligible.



- SCALE -

1000' 0 1000' 2000' 3000'

FROM: U.S.G.S. TOLLAND CENTER, MASS.-CONN. QUADRANGLE MAP

QUADRANGLE LOCATION

TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

SOUTHERN DAM (TWINING POND DAM) MA 00321
LOST WILDERNESS LAKE
HAMPDEN COUNTY

TOLLAND
MASSACHUSETTS

SCALE: AS NOTED

DATE: DECEMBER 1979

PROBABLE DOWNSTREAM IMPACT OF DAM FAILURE

Lost Wilderness Lake (MA 00321)
Southern Dam (Twining Pond)

Location	No. of Houses	Other Damage	Flow Rates		River Stage		Comments
			Before Failure CFS	After Failure CFS	Before Failure FT	After Failure FT	
1. Downstream of Dam	0	---	800	12,500	1.8	8.1	No Significant Damage
2. 1500 ft. D.S East Otis Road	0	Culvert	800	12,300	6.9	9.6	Before failure roadway overtopped 1.9 ft.; after failure roadway overtopped 4.6 ft.
3. 3700 ft. D.S. Route 57	1	Culvert	800	12,000	8.3	11.1	Before failure road overtopped 1.8 ft., 1 house minor flooding; after failure road overtopped 4.6 ft., 1 house flooded 3 ft.
4. 6400 ft. D.S. 1 House	1	---	800	11,900	1.0	5.9	Before failure no damage; after failure 1 houre minor flooding.
5. 7300 ft. D.S. New Route 8	0	Culvert	800	11,800	2.0	17.5	Before failure no damage; after failure road overtopped 2.5 ft.
6. 7800 ft. D.S. Old Route 8	3	Culvert	800	11,800	2.0	3.9	Before failure minor flooding of road; after failure road overtopped 1.9 ft. and minor flooding of 3 houses.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

There has been no significant displacement or distress which would warrant the preparation of structrual stability calculations.

6.2 Design and Construction Data

The design material made available for this review was insufficient to determine the structural stability of the embankment.

Some field testing was carried out during the construction phase including a few sieve analyses and compaction tests.

A review of the structural calculations for the design of the drop inlet principal spillway structure indicate that this structure has been designed on the basis of sound engineering practice.

6.3 Post Construction Changes

There have been no known modifications since the work was completed in 1976.

6.4 Seismic Stability

The Twining Pond Dam is located in seismic zone 1. According to the recommended Corps. of Engineers' guidelines a seismic analysis is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The dam and its appurtenances are generally in good condition at the present time with the exception of the outlet conduit, toe drains and plunge pool which are in fair condition.

(b) Adequacy of Information

There is insufficient design and construction data to permit a complete assessment of dam safety.

(c) Urgency

The recommendations and remedial measures described herein should be implemented by the owner within one year of receipt of this Phase I Inspection Report.

7.2 Recommendations

The recommendations of this Phase I investigation are that the following additional studies and actions be carried out under the supervision of a qualified registered professional engineer:

(a) Determine the cause of the wet spongy condition along the left downstream toe of the embankment and what corrective measures, if any, may be required.

(b) Determine the cause of the wet spongy condition at the toe of the downstream face of the emergency spillway and what corrective measures, if any, may be required.

(c) Complete the construction of the stilling basin as shown on the design plans.

7.3 Remedial Measures

The recommendation of this Phase I investigation is that the following remedial and/or maintenance items be carried out:

(a) Clarify ownership and responsibility for operation and maintenance of the dam.

(b) Establish a program of monitoring procedures at the dam during and just after periods of intense rainfall.

(c) Establish a downstream emergency flood warning system.

(d) Check the operability of the pond drain inlet gate as part of an annual inspection procedure.

(e) Clear and maintain the area around the discharge of the toe drains to assure that blockage will not occur.

(f) Implement and intensify a program of diligent and periodic maintenance including, but not limited to: mowing embankment slopes; backfilling drainage gullies, tire ruts, and animal burrows with suitable, well tamped soil; and clearing debris from the trash racks, the upstream face of the embankment and the emergency spillway.

(g) Remove the plank to the riser structure.

(h) Fill low spots on the top of the dike and the top of the dam.

(i) Institute a program of annual periodic technical inspection.

(j) Replace missing base plate nuts on sluice gate bench stand.

(k) Remove debris in the emergency spillway entrance.

(l) Repair spalling on the top of outlet pipe.

(m) Discourage the passage of vehicles on the embankment and emergency spillway.

7.4 Alternatives

There are no meaningful alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Lost Wilderness Lake Dam No. MA 00321 DATE 10/31/79

(Twining Pond Dam) Southern Dam
Tolland, Massachusetts

TIME 10 A.M.

WEATHER Sunny & Clear

W.S. ELEV. _____ U.S. ____ D.S.

PARTY:

1. J.V. Powers	T&B/SCI	6.	
2. G.H. McDonnell	T&B/SCI	7.	
3. E.A. Moe	T&B/SCI	8.	
4. H.A. Koski	T&B/SCI	9.	
5. O.H. Dumais	T&B/SCI	10.	

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	All project features were inspected by all party members.		
2.			
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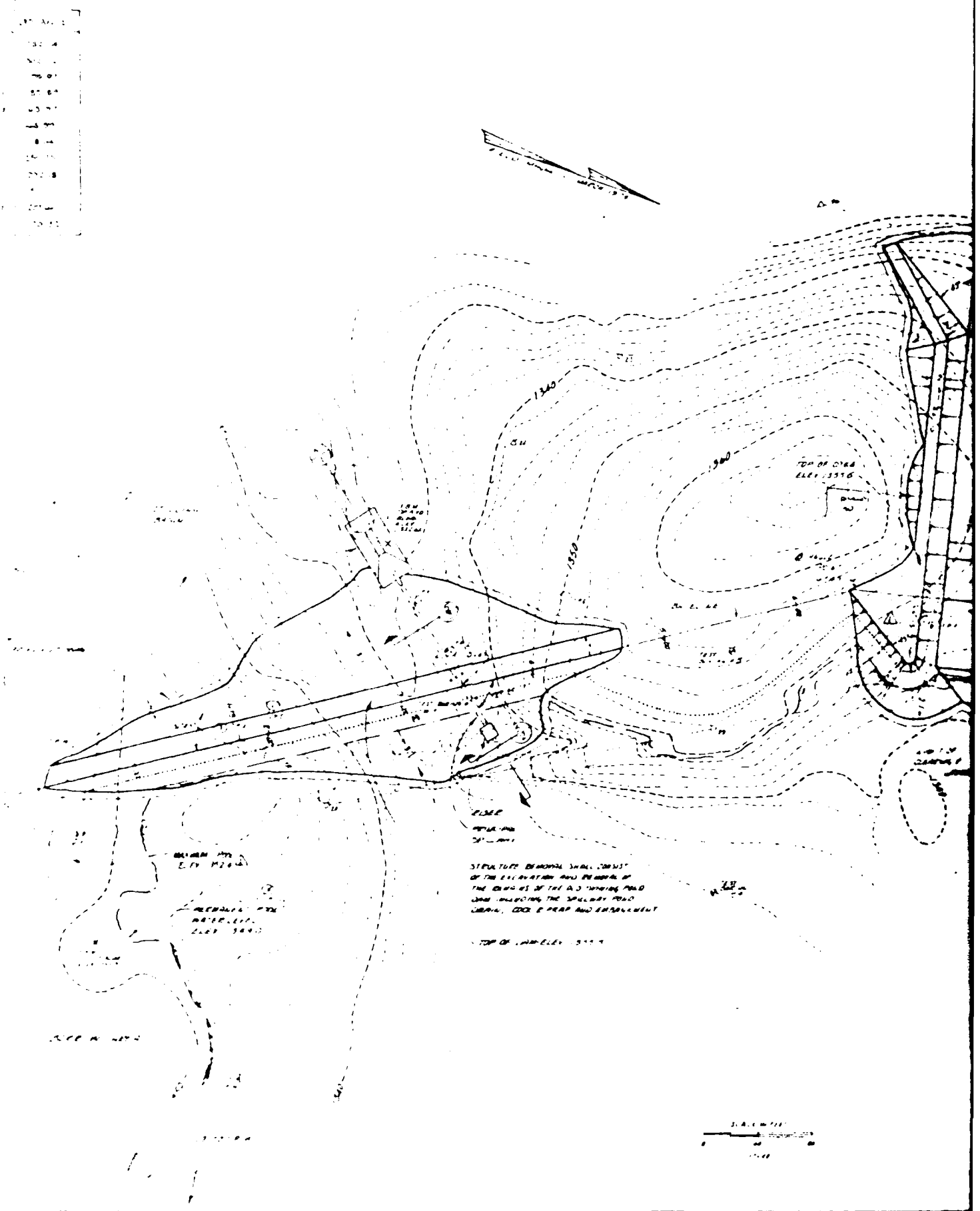
INSPECTION CHECK LIST

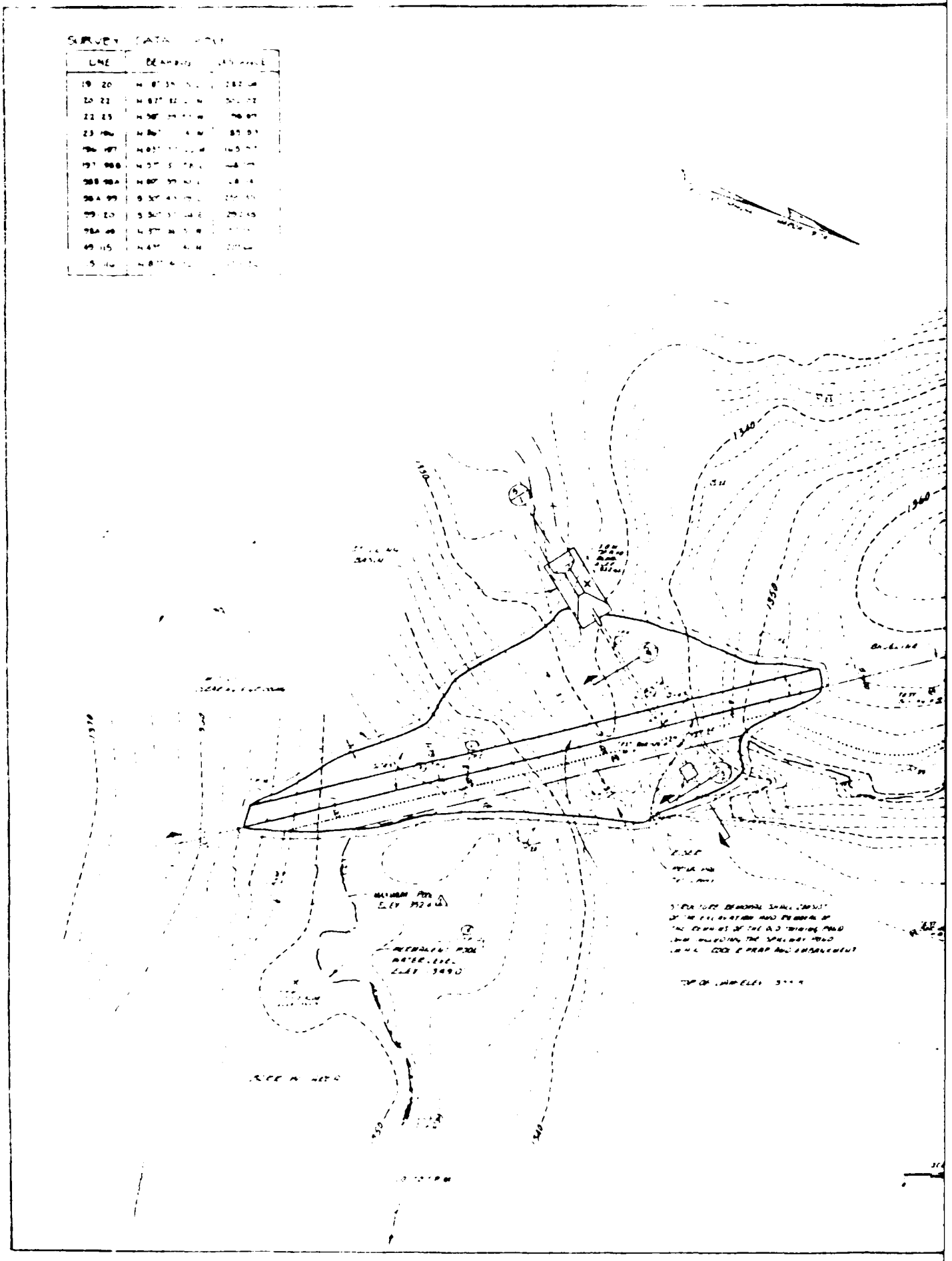
PROJECT Lost Wilderness Lake Dam No. MA 00321 DATE 10/31/79

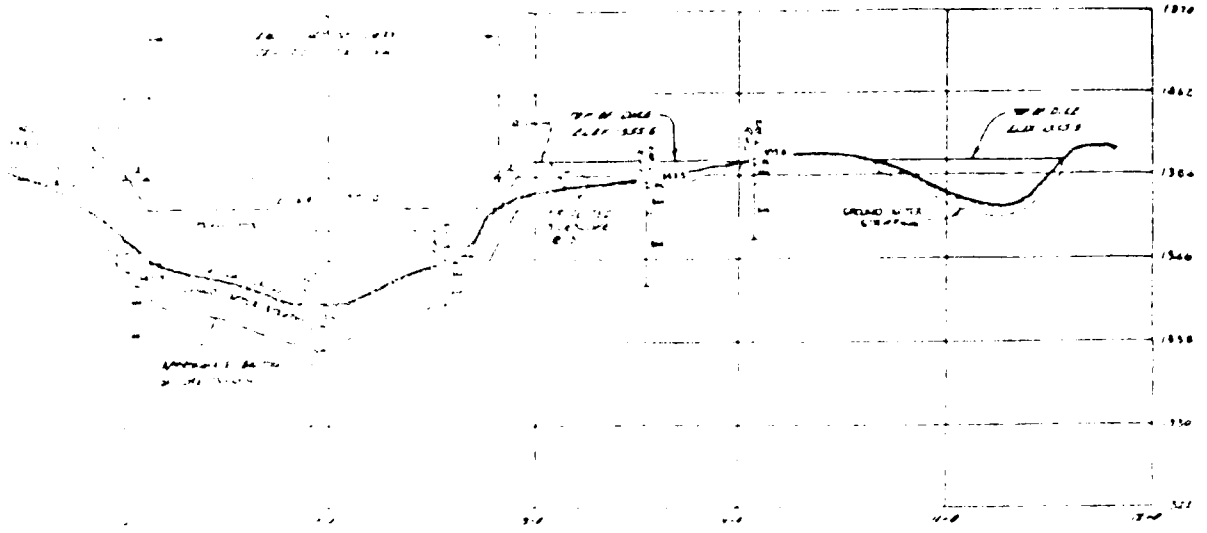
INSPECT FEATURE (Retaining Pond Dam) Dam NAME Southern

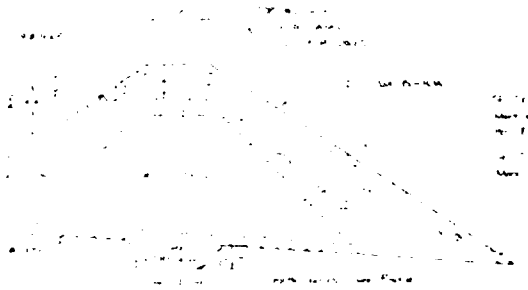
INSPECTED NAME

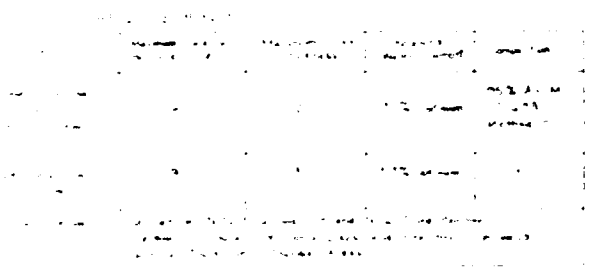
AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	1355.5 from Design Plans
Current Pool Elevation	1349.0 from Design Plans
Maximum Impoundment to Date	Unknown
Surface Cracks	None Apparent
Pavement Condition	Not Applicable
Movement or Settlement of Crest	None Apparent
Lateral Movement	None Apparent
Vertical Alignment	Good - some low spots (4"-6") on crest
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None Apparent
Trespassing on Slopes	Some tire marks on downstream slope
Vegitation on Slopes	Grass & weeds 4" to 6" deep
Sloughing or Erosion of Slopes or Abutments	Some erosion on downstream slope 4" to 6" deep
Rock Slope Protection - Riprap Failures	No apparent failures on upstream slope rip rap
Unusual Movement or Cracking at or near Toes	None Apparent
Unusual Embankment or Downstream Seepage	Small stream of water along toe of the easterly downstream slope-some till material
Piping or Boils	None Apparent
Foundation Drainage Features	Toe Drains - very slight flow
Toe Drains	2 drains outlet becoming clogged by long grass
Instrumentation System	None











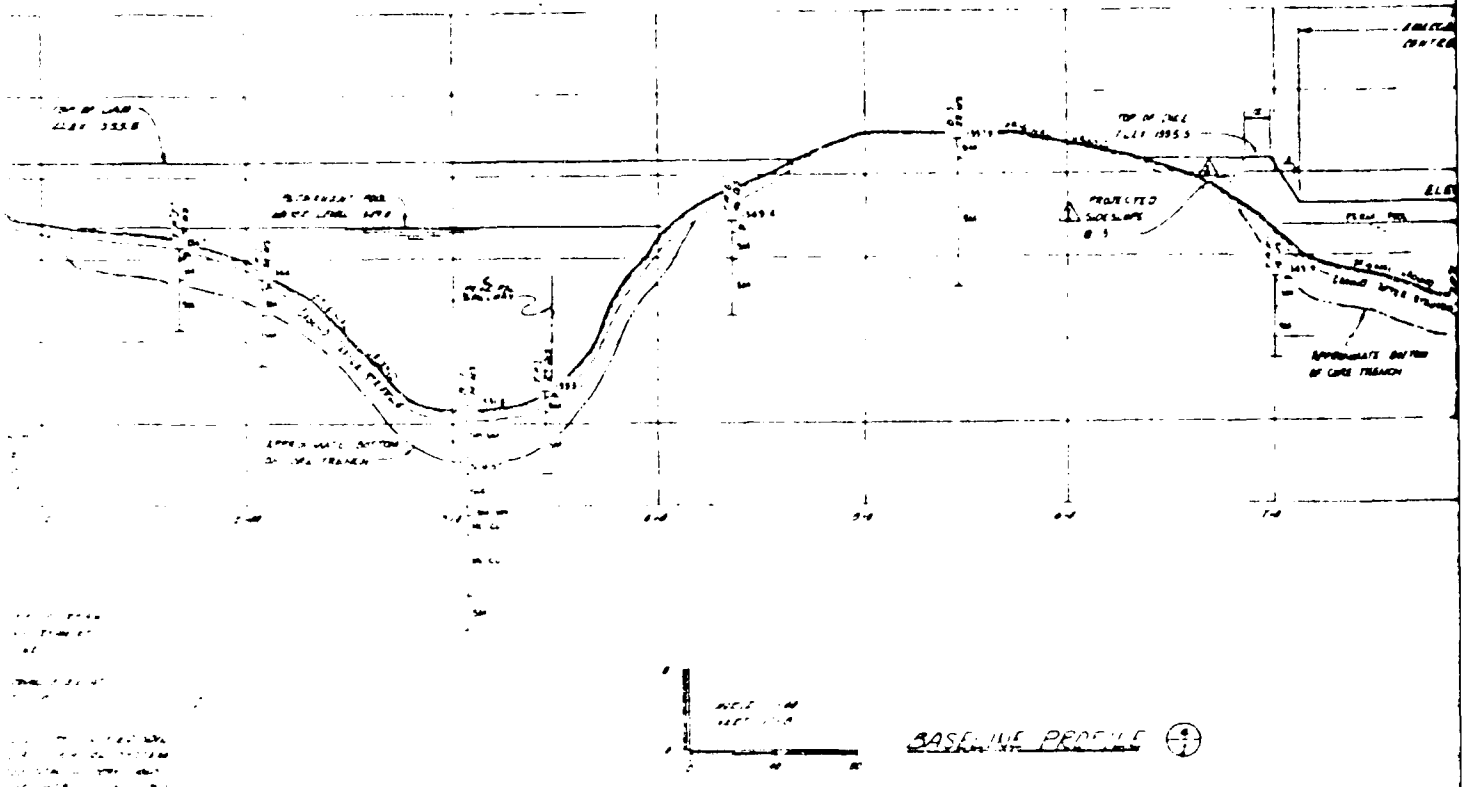
LOST WILDERNESS LAKE

TYLAND, MASSACHUSETTS

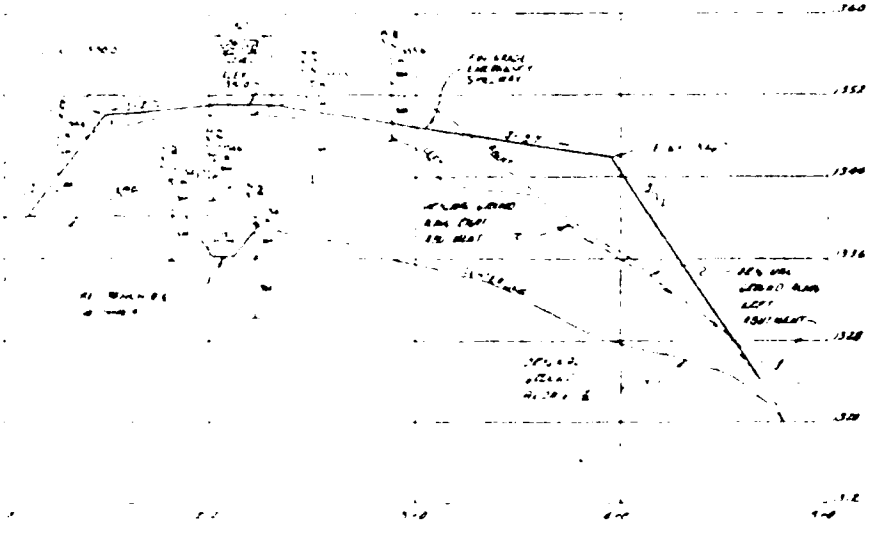
TWINING POND DAM PROFILES

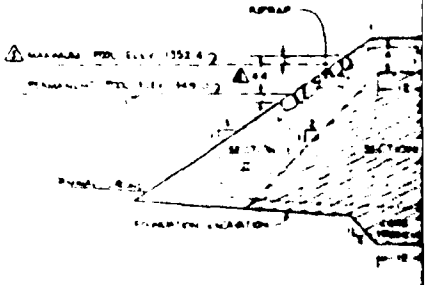
SHEET NO. 4

TM [illegible] & ASSOCIATES, INC.



BASELINE PROFILE (9)



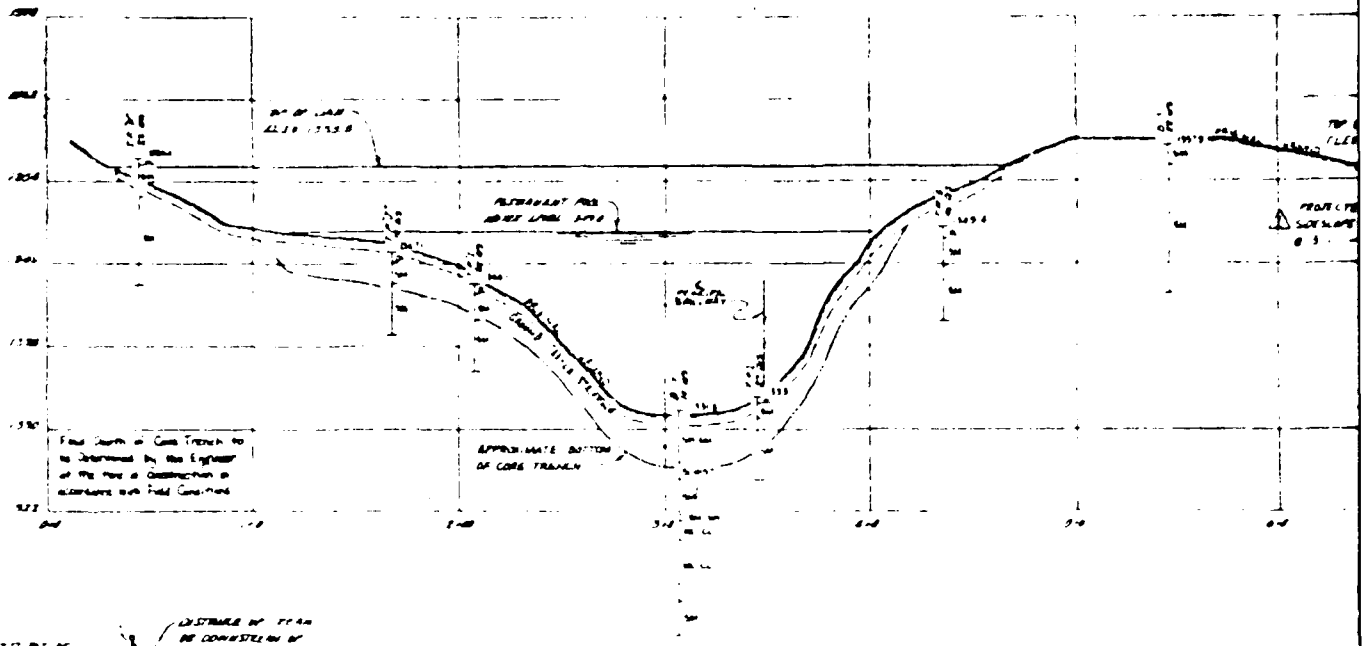


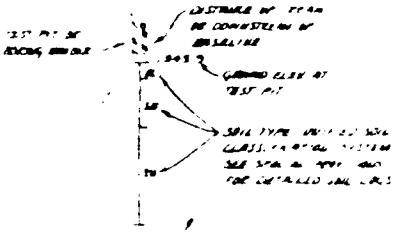
TYPICAL SECTION - EA

EARTH FILL REQUIREMENTS

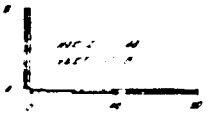
Zone	
Gravel Borrow or Sand Borrow	
Impervious Soil Borrow	
Loam Borrow	

RIPRAP REQUIREMENTS

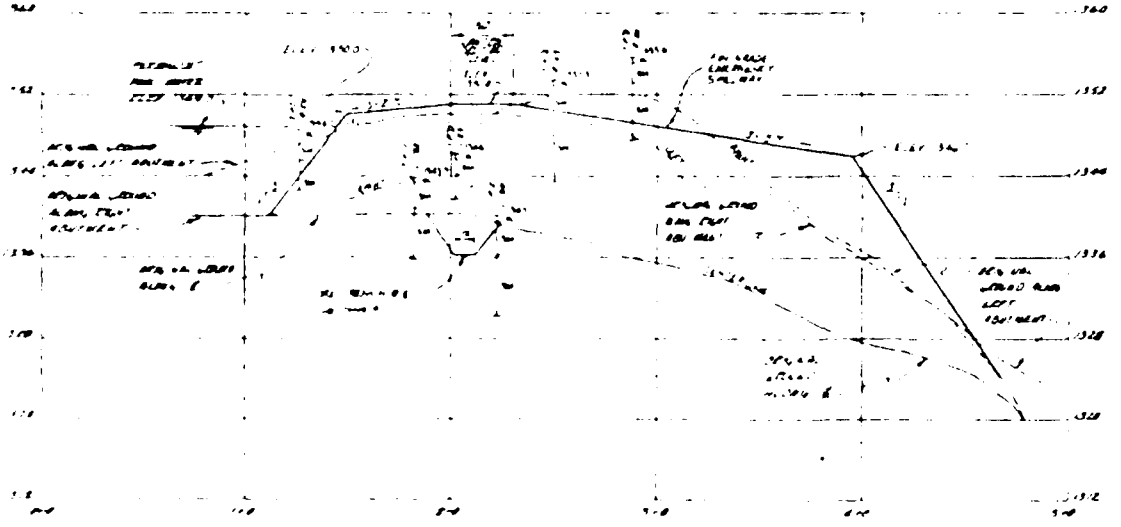


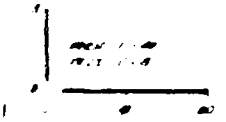


TEST PIT INFORMATION



BASELINE PROFILE





APPENDIX B

ENGINEERING DATA

INSPECTION CHECK LIST

PROJECT Lost Wilderness Lake Dam No. MA00321 DATE 10/31/79

PROJECT FEATURE Twining Pond Dike (Southern Dam) NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	
Crest Elevation	1355.5 ft MSL (from Design Plans)
Current Pool Elevation	1349.0 ft. MSL (from Design Plans)
Maximum Impoundment to Date	Unknown
Surface Cracks	None Apparent
Pavement Condition	Not Applicable
Movement or Settlement of Crest	One foot deep depression located top center of dike
Lateral Movement	None Apparent
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None Apparent
Trespassing on Slopes	None Observed
Vegitation on Slopes	Grass & Weeds
Sloughing or Erosion of Slopes or Abutments	None Apparent
Rock Slope Protection - Riprap Failures	Not Applicable
Unusual Movement or Cracking at or near Toes	None Apparent
Unusual Embankment or Downstream Seepage	None Apparent
Piping or Boils	None Apparent
Foundation Drainage Features	Not Applicable
Toe Drains	Not Applicable
Instrumentation System	None

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Lost Wilderness Lake Dam No. MA 00321
Twining Pond Dike
(at Twining Pond Dam) Southern Dam
Tolland, Massachusetts

DATE 10/31/79

TIME 10 A.M.

WEATHER Sunny & Clear

W.S. ELEV. _____ U.S. _____ DN.S.

PARTY:

1. J.W. Powers, Tighe & Bond/SCI
2. G.H. McDonnell, Tighe & Bond/SCI
3. E.A. Moe, Tighe & Bond/SCI
4. H.A. Koski, Tighe & Bond/SCI
5. O.H. Dumais, Tighe & Bond/SCI
6. _____
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	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	All project features were inspected by all party members.		
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INSPECTION CHECK LIST

PROJECT Lost Wilderness Lake Dam No. MA 00321 DATE 10/31/79

PROJECT FEATURE (Twining Pond Dam) Southern Dam NAME

DESCRIBED NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	There is no service bridge at this site.
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

INSPECTION CHECK LIST

PROJECT Lost Wilderness Lake Dam No. MA 00321 DATE 10/31/79

PROJECT FEATURE (Twining Pond Dam) Southern Dam NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	Emergency Spillway
a. Approach Channel	
General Condition	Grass covered earth spillway - some debris at entrance
Loose Rock Overhanging Channel	There are two rock outcrops on the sidewalls
Trees Overhanging Channel	None
Floor of Approach Channel	Grass with some debris (stumps & logs)
b. Weir and Training Walls	
General Condition of Concrete	None
Rust or Staining	Grass only
Spalling	Not Applicable
Any Visible Reinforcing	Not Applicable
Any Seepage or Efflorescence	Not Applicable
Drain Holes	Not Applicable
c. Discharge Channel	
General Condition	Grass covered slope with some tire ruts and erosion along downstream slope
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Grass
Other Obstructions	Area directly downstream is thickly wooded. At toe of slope there is a very wet area-when stepping on this soil it becomes very soft and fluid - area completely saturated.

INSPECTION CHECK LIST

PROJECT Lost Wilderness Lake Dam No. MA 00321 DATE 10/31/79

PROJECT FEATURE (Twining Pond Dam) Southern Dam NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	There is no outlet structure. The stilling basin shown on the plans was not constructed. The existing plunge pool is not fully protected by rip rap. Toe drains simply discharge on downstream slope of the embankment.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain holes	
Channel	
Loose Rock or Trees Overhanging Channel	Channel is 3 to 4 feet wide and quite shallow. The channel makes a bend to return to the original location. The area is thickly wooded with many dead and fallen trees.
Condition of Discharge Channel	

INSPECTION CHECK LIST

PROJECT Lost Wilderness Lake Dam No. MA.00321 DATE 10/31/79

PROJECT FEATURE (Twining Pond Dam) Southern Dam NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	No stilling basin as shown on plans
Rust or Staining on Concrete	None
Spalling	Concrete pipe spalling on top outside face
Erosion or Cavitation	None Apparent
Cracking	None Apparent
Alignment of Monoliths	Not Applicable
Alignment of Joints	Good alignment & grade, no cracking or infiltration visible for those joints visible from plunge pool
Numbering of Monoliths	Not Applicable

INSPECTION CHECK LIST

PROJECT Lost Wilderness Lake Dam No. MA 00321 DATE 10/31/79

PROJECT FEATURE (Twining Pond Dam) Southern Dam NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	None Apparent
Spalling	None visible above water level
Visible Reinforcing	None
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None
Joint Alignment	Not Applicable
Unusual Seepage or Leaks in Gate Chamber	Not Applicable
Cracks	None Apparent
Rusting or Corrosion of Steel	None Apparent
b. Mechanical and Electrical	
Air Vents	Not Applicable
Float Wells	Not Applicable
Crane Hoist	Not Applicable
Elevator	Not Applicable
Hydraulic System	Not Applicable
Service Gates	Sluice gate bench stand missing nuts otherwise in good condition
Emergency Gates	Rodney Hunt Model S-5002
Lightning Protection System	Not Applicable
Emergency Power System	Not Applicable
Wiring and Lighting System in Gate Chamber	Not Applicable

INSPECTION CHECK LIST

PROJECT Lost Wilderness Lake Dam No. MA 00321 Southern DATE 10/31/79

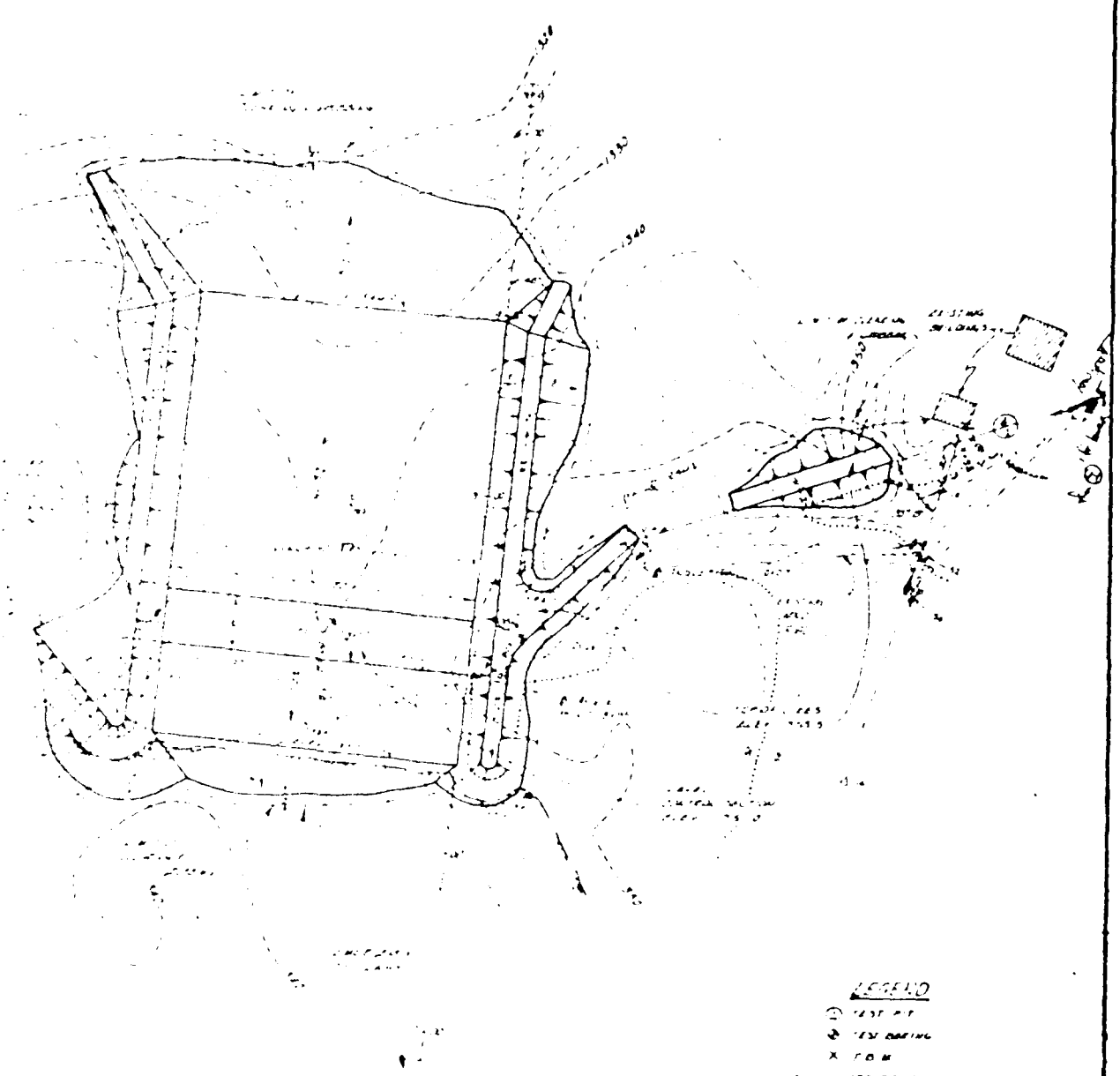
PROJECT FEATURE (Twining Pond Dam) Dam NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Reservoir
Slope Conditions	Not Applicable
Bottom Conditions	Not Applicable
Rock Slides or Falls	Not Applicable
Log Boom	Not Applicable
Debris	Some debris floating on Reservoir
Condition of Concrete Lining	Not Applicable
Drains or Weep Holes	Not Applicable
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	No stop logs No slots were noticed

NOTES

1. [illegible]
2. [illegible]



LEGEND

- TEST PIT
- TEST BORING
- FOUND
- CENTERLINE
- BASELINE
- TOP OF SLOPE
- TOE OF SLOPE
- LIMIT OF CLEARING & GRUBBING
- SHEET NUMBER OF WHICH SECTION IS SHOWN
- TOE OF CUT OR FILL
- NORMAL POOL ELEV.

LOST WILDERNESS LAKE
TOLLAND, MASSACHUSETTS

TWINING POND DAM
SITE PLAN

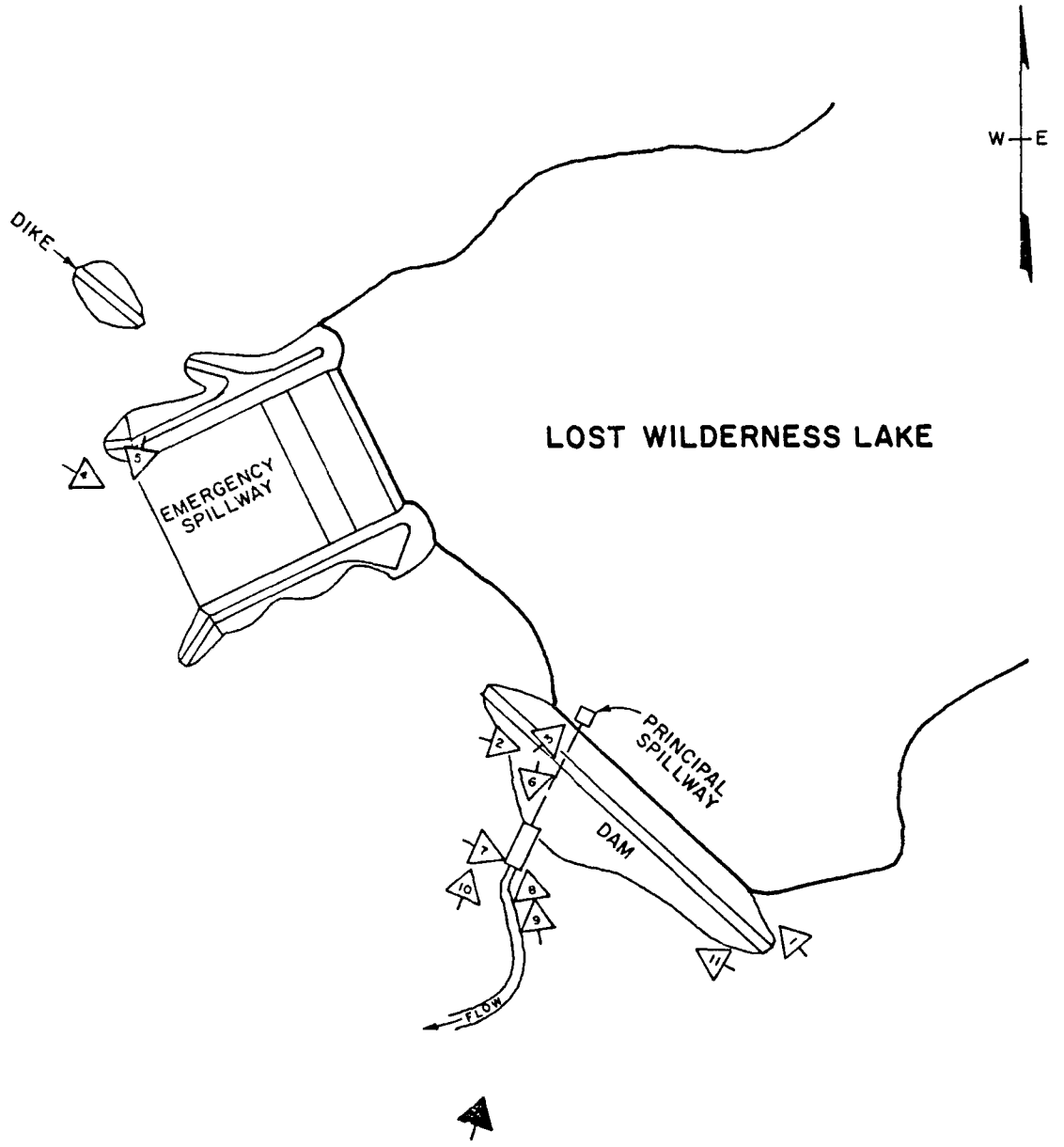
DESIGNED RSA
DRAWN DRC
CHECKED RSA

SHEET NO. 3

BROWN, MOTHRAN & ASSOCIATES, INC.

APPENDIX C

PHOTOGRAPHS



TWINING POND DAM

TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

OVERVIEW (AERIAL)

APPENDIX C

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

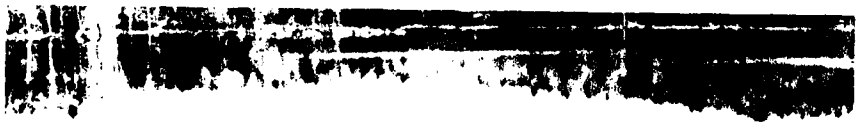
LOCATION AND ORIENTATION OF PHOTOS

SOUTHERN DAM (TWINING POND DAM) MA 00321
LOST WILDERNESS LAKE — TOLLAND
HAMPDEN COUNTY — MASSACHUSETTS

			SCALE: NONE
			DATE: DECEMBER 1979

Photo 1 - Dam overview looking westerly from left abutment

Photo 2 - Dam overview looking easterly from right abutment



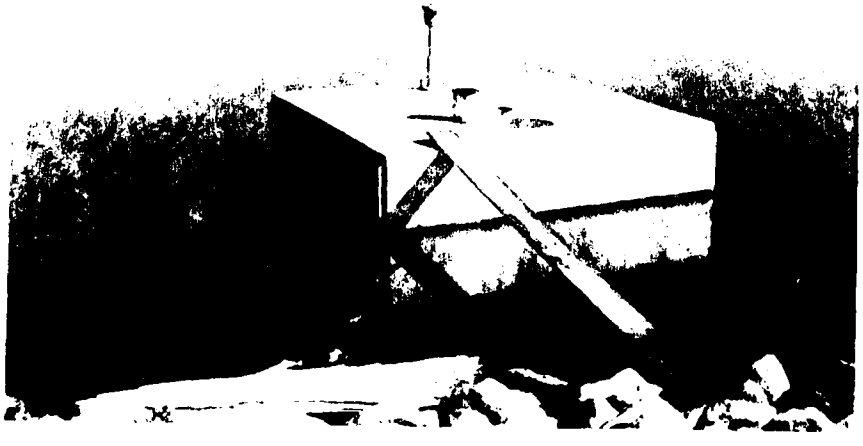


Photo 3 - Principal spillway drop inlet riser structure

Photo 7 - Discharge of 36" principal spillway pipe. Note spalling at top of pipe.

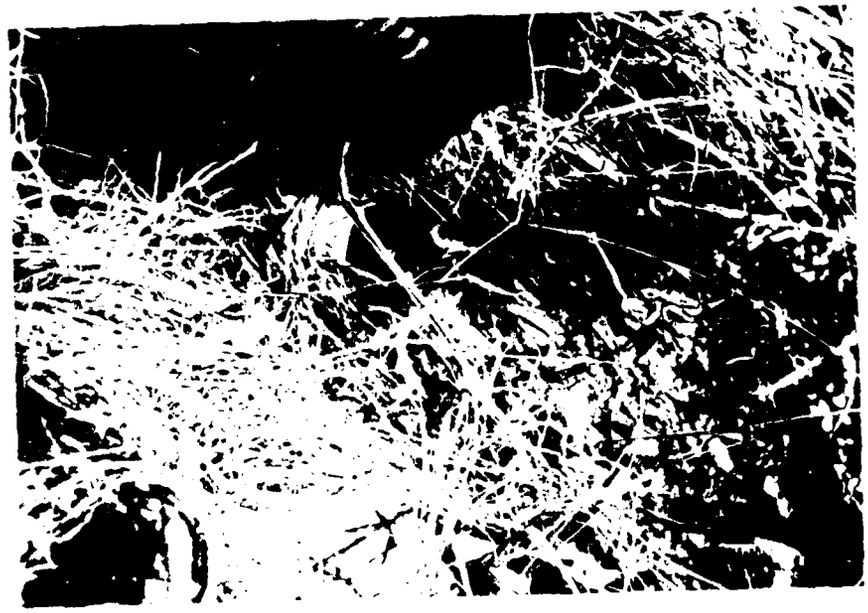
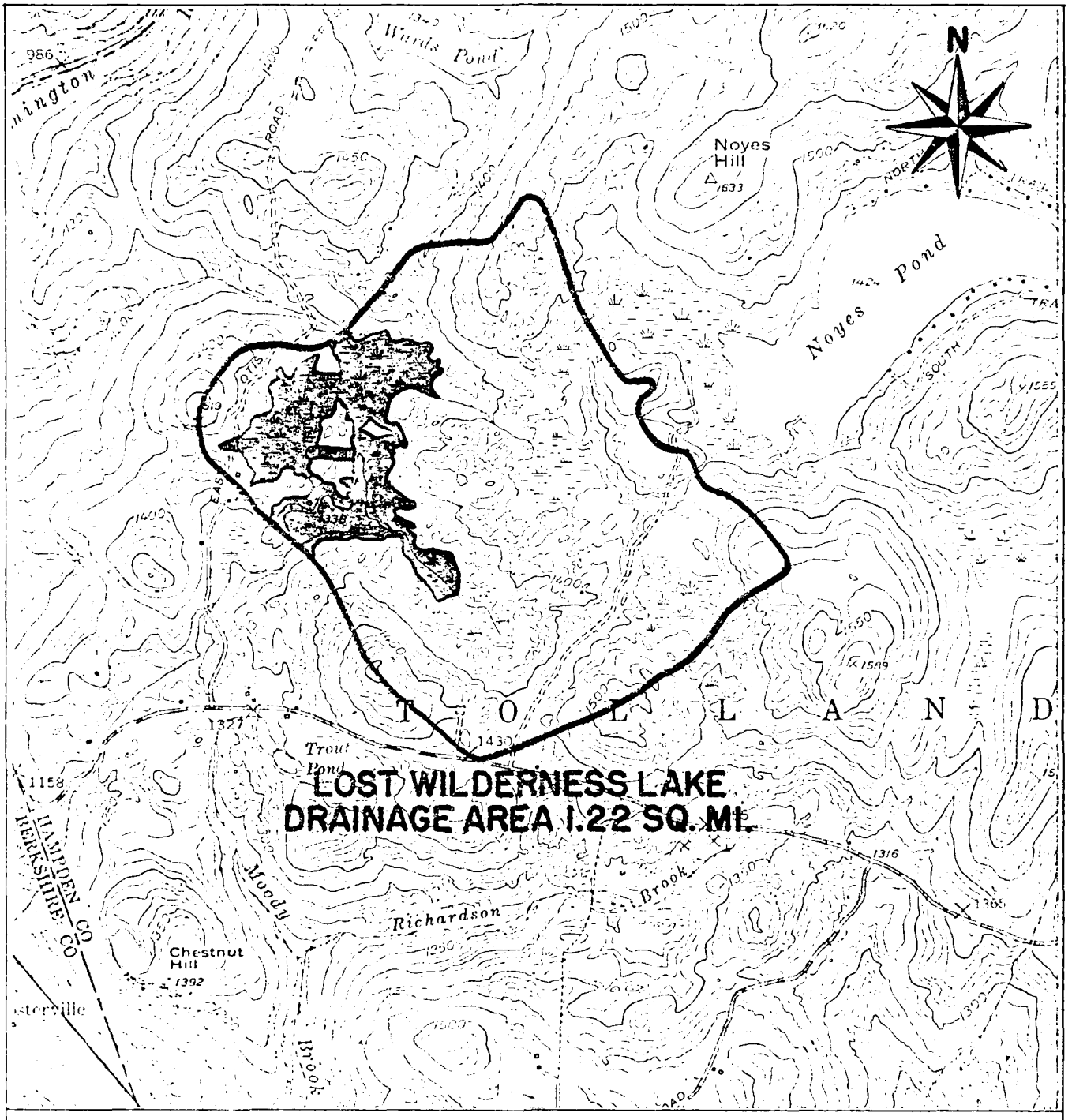


Photo 8 - Discharge of 36" principal spillway. Note that toe drains are completely covered by grass.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



- SCALE -

1000' 0 1000' 2000' 3000'

FROM: U.S.G.S. TOLLAND CENTER, MASS.-CONN. QUADRANGLE MAP

QUADRANGLE LOCATION

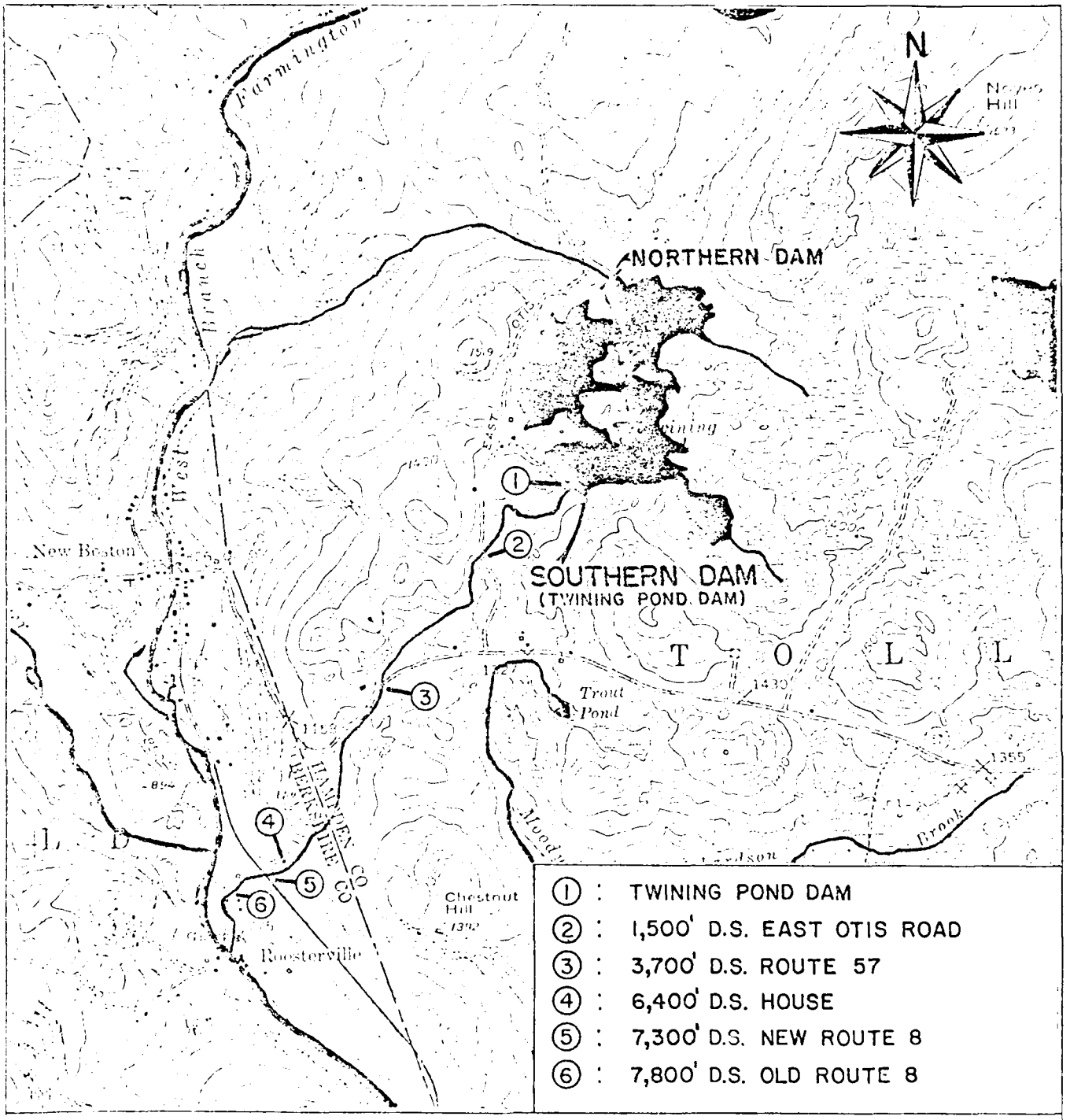
TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DRAINAGE AREA MAP

SOUTHERN DAM (TWINING POND DAM) MA00321
LOST WILDERNESS LAKE — TOLLAND
HAMPDEN COUNTY — MASSACHUSETTS

			SCALE : AS NOTED
			DATE : DECEMBER 1979



-SCALE-

1000' 0 1000' 2000' 3000'

FROM: U.S.G.S. TOLLAND CENTER, MASS.-CONN. QUADRANGLE MAP

QUADRANGLE LOCATION

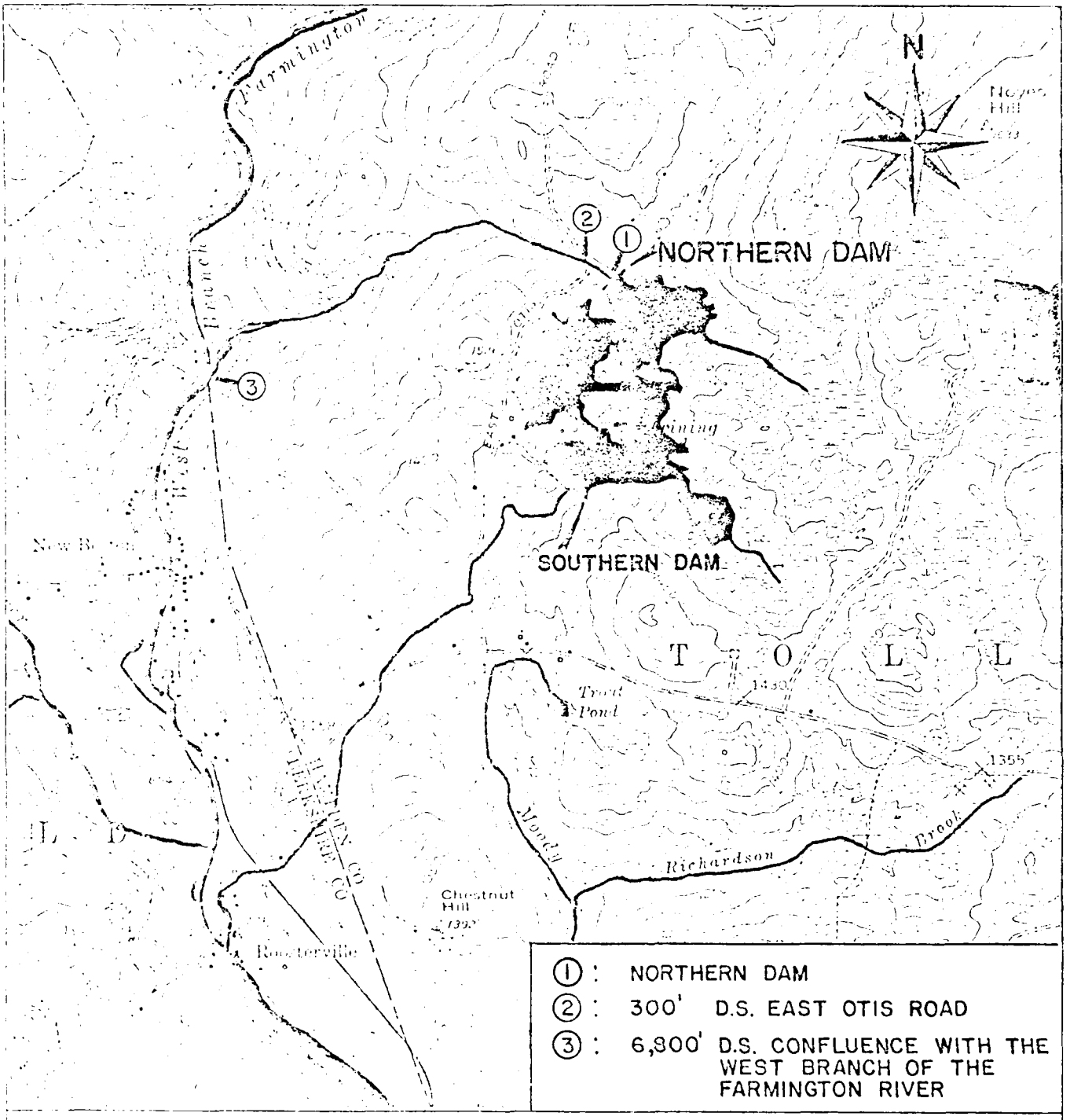
TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

SOUTHERN DAM (TWINING POND DAM) MA 00321
LOST WILDERNESS LAKE — TOLLAND
HAMPDEN COUNTY — MASSACHUSETTS

			SCALE: AS NOTED
			DATE: DECEMBER 1979



-SCALE-

0 1000' 2000' 3000'

FROM U.S.G.S. TOLLAND CENTER, MASS.-CONN. QUADRANGLE MAP

QUADRANGLE LOCATION

TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

NORTHERN DAM (MA 01059)
LOST WILDERNESS LAKE
HAMPDEN COUNTY

TOLLAND
MASSACHUSETTS

SCALE: AS NOTED

DATE : DECEMBER 1979

Calculations based on information from U.S.G.S. Map - Tolland Center Quad.

scale 1" = 2000'

1 sq. in = 91.83 Acres or 0.143 sq. miles.

Drainage Area

By planimeter = 1.18 sq. mi. - from Construction Plans = 1.22 sq. mi.

Use 1.22 sq. miles = 781 Acres

Surface Area of Lake

1. @ Elevation 1349 (Normal Pool Elev.)

By planimeter = 105 Acres - from Construction Plans = 100 Acres

Use 100 Acres

2. @ Elevation 1351 (Emergency Spillway Crest)

Since topo is fairly uniform between 1349 & 1360 - assume straight interpolation

$\frac{11'}{85} = \frac{2'}{x}$ $11x = 170$ $x = 15.5$ say 16 Acres; Elev 1351 → 100+16 = 116 Acres

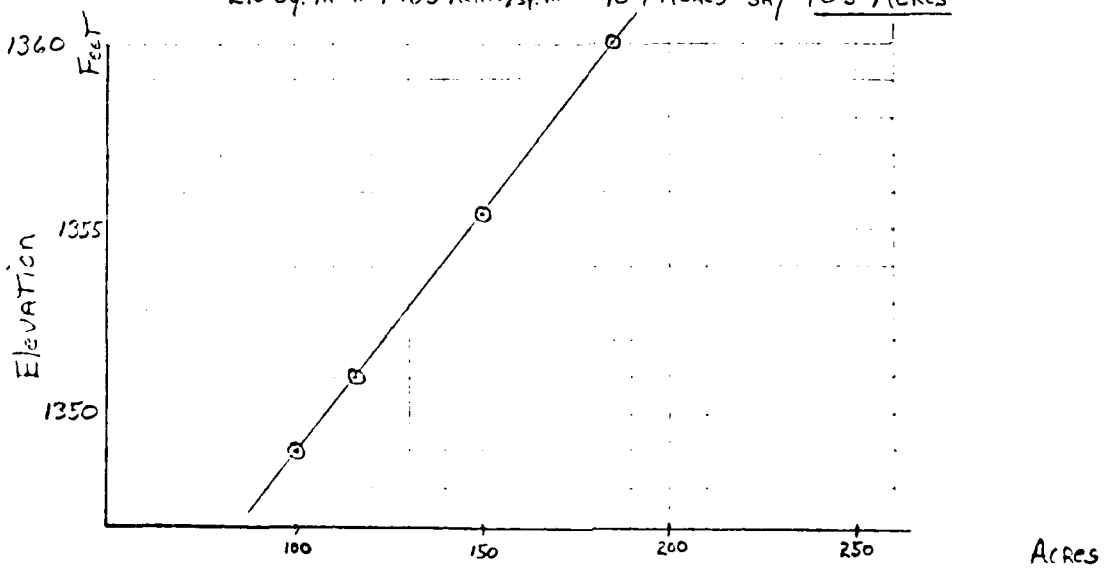
3. @ Elevation 1355.5 (Top of Dams)

Same as No. 2 above

$\frac{11}{85} = \frac{6.5}{x}$ $11x = 552.5$ $x = 50.2$ say 50 Acres; Elev 1355.5 → 100+50 = 150 Acres

4. @ Elevation 1360

2.0 sq. in x 91.83 Acres/sq. in = 184+ Acres say 185 Acres

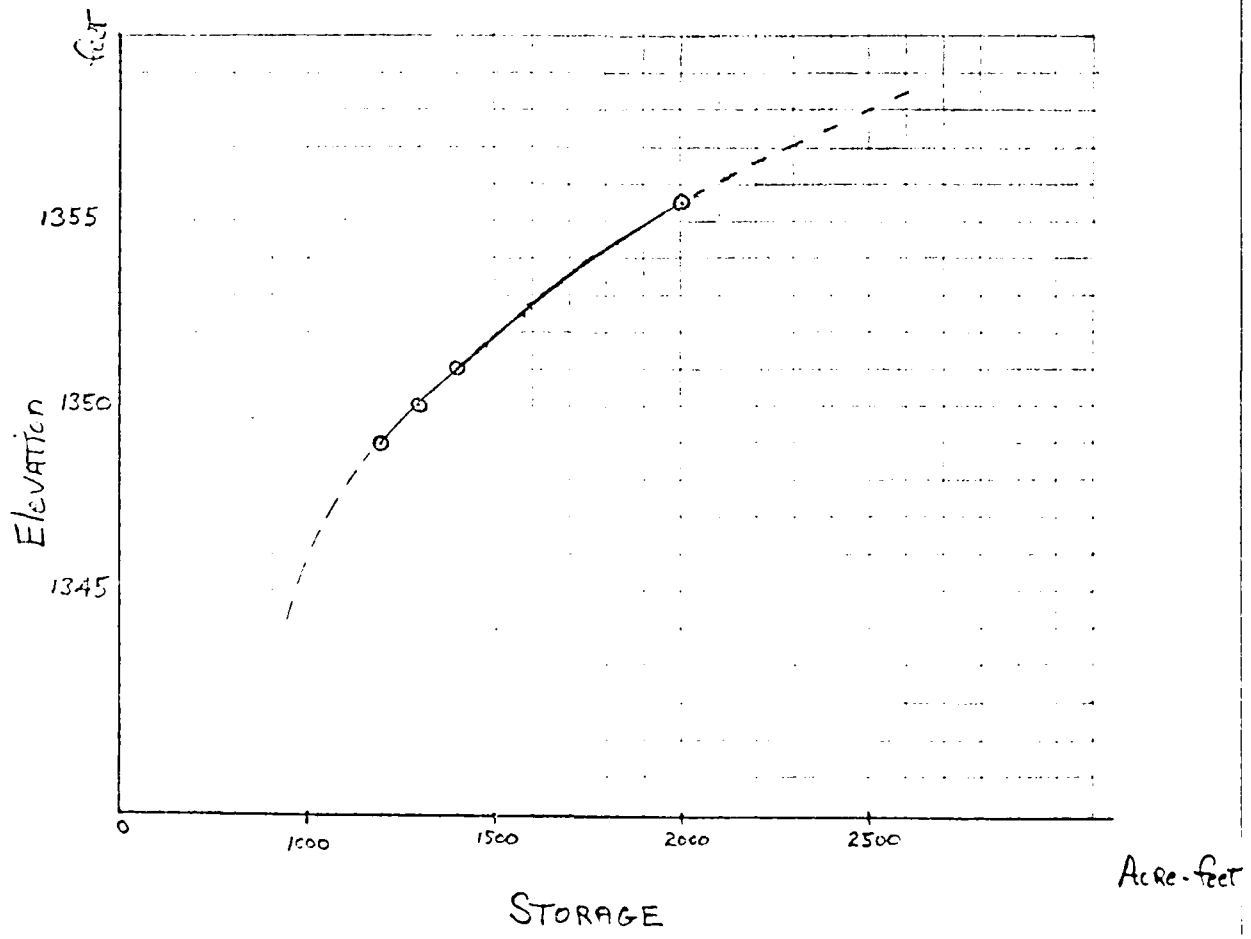


Drainage Area

Storage

Assume Avg. depth of Pond = 12' @ 1349

Elev	Area	Height (Above Normal Pool Elev.)	Storage (Approx.)
1349	100 Ac.	27' (0)	1200 Ac.-Ft.
1350	108 Ac.	28' (1)	1300 Ac.-Ft
1351	116 Ac.	29' (2)	1400 Ac.-Ft
1355.5	150 Ac.	33.5' (6.5)	2000 Ac.-Ft



Size Classification

Height : Southern Dam (Twining Pond) 27' between 25' & 40' ∴ SMALL
Northern Dam 23'

STORAGE = 1,200± ACRE-FEET @ Normal Pool – between 1000 & 50,000 ∴ INTERMEDIATE
2,000± A-F @ Top of DAM

CLASSIFICATION : INTERMEDIATE

HAZARD POTENTIAL

Southern Dam, (Twining Pond) – Significant
Northern Dam – Low

See Text For Failure analysis Description.

Test Flood

Recommended Spillway Design Flood — ½ PMF to PMF

Use ½ PMF

Classification of TERRAIN in DRAINAGE AREA

The AREA is primarily Rolling TERRAIN with a few sections of freshwater MARSH. Rolling TERRAIN will be used in determining the Peak Flow RATES.

Spillway RATING

1. Use ½ P.M.F.
2. Assume Rolling TERRAIN
3. DRAINAGE AREA = 1.22 sq. miles
4. Use the "MAXIMUM PROBABLE FLOOD PEAK FLOW RATES" curves and extrapolate for a drainage AREA of 1.22 sq. miles.

(See next sheet)

Flow over STATE ROUTE 57

$Q = 12,000 - 280 = 11,720$ cfs

Broad crested weir flow over road:

$$H = \left(\frac{11,720}{249\,(3)}\right)^{2/3}$$

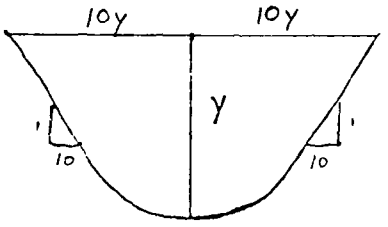
$H = 6.3$ ft Depth over Road $\approx \frac{2}{3}(6.3) = 4.2$ ft.

∴ The road will be overtopped by approximately 4.2 ft.

4) Compute Effect at Route 8, The section is taken 900'± upstream of Route 8

Reach = 2700'

Open Channel @ end of steep slope



$A_{REA} = 10y^2$

$W.P. = 10.04y + 10.04y = 20.1y$

$S = 15\%$

$R = A/W.P. = 10y^2/20.1y = 0.498y$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

Assume $y = 5'$

$A = 10y^2 = 250$ s.f. $\quad W.P. = 20.1y = 100.5$ ft

$R = 0.498y = 2.49$

$$Q = \frac{1.486}{0.03}(250)(2.49)^{2/3}(0.15)^{1/2}$$

$Q = 8,838$ cfs.

Channel Vol = Reach x Area

for Q_{p_1} = 12,300 c.f.s.

from graph on pp. 15 y = 7.8 ft.

$$Vol = (2,200)\left(\frac{15(7.8)^2}{43,560}\right) - 1.3 = 45 \text{ ac. ft}$$

(See page D-34)

S = 2,000 Acre-Feet

$$Q_{p_2}(\text{TRIAL}) = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$$

$$= 12,300\left(1 - \frac{45}{2,000}\right) = 12,000 \text{ cfs}$$

Q_{p_2} (TRIAL) = 12,000 cfs

Using Q_{p_2} (TRIAL) = 12,000 cfs

from graph on pp 15 y = 7.7 ft.

$$Vol = (2,200)\left(\frac{15(7.8)^2}{43560}\right) - 1.3 = 44 \text{ ac. ft}$$

$$V_{ave.} = \frac{45+44}{2} = 44.5 \text{ ac. ft}$$

$$Q_{p_2} = 12,300\left(1 - \frac{44.5}{2000}\right) = 12,000 \text{ ac. ft.}$$

Flow thru culvert

Inlet loss = $0.9\ V^2/2g$

Outlet loss = $1.0\ V^2/2g$

Pipe loss = $0.2\ V^2/2g$ ($h_L = f\frac{L}{d}\frac{V^2}{2g}$ where f = 0.02, L = 40' & d = 5.3')

$H = 2.1\ V^2/2g$

for h = 5.3' V = 12.7 fps Q = 280 cfs (Assume no surcharge)

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

Assume $y = 5'$

$A = 15y^2 = 375$ s.f. W.P. $= 30.1y = 150.5$ ft

$R = 0.498y = 2.49$

$$Q = \frac{1.486}{0.03} \times 375 (2.49)^{2/3} (0.02)^{1/2}$$

$Q = 4{,}840$ c.f.s.

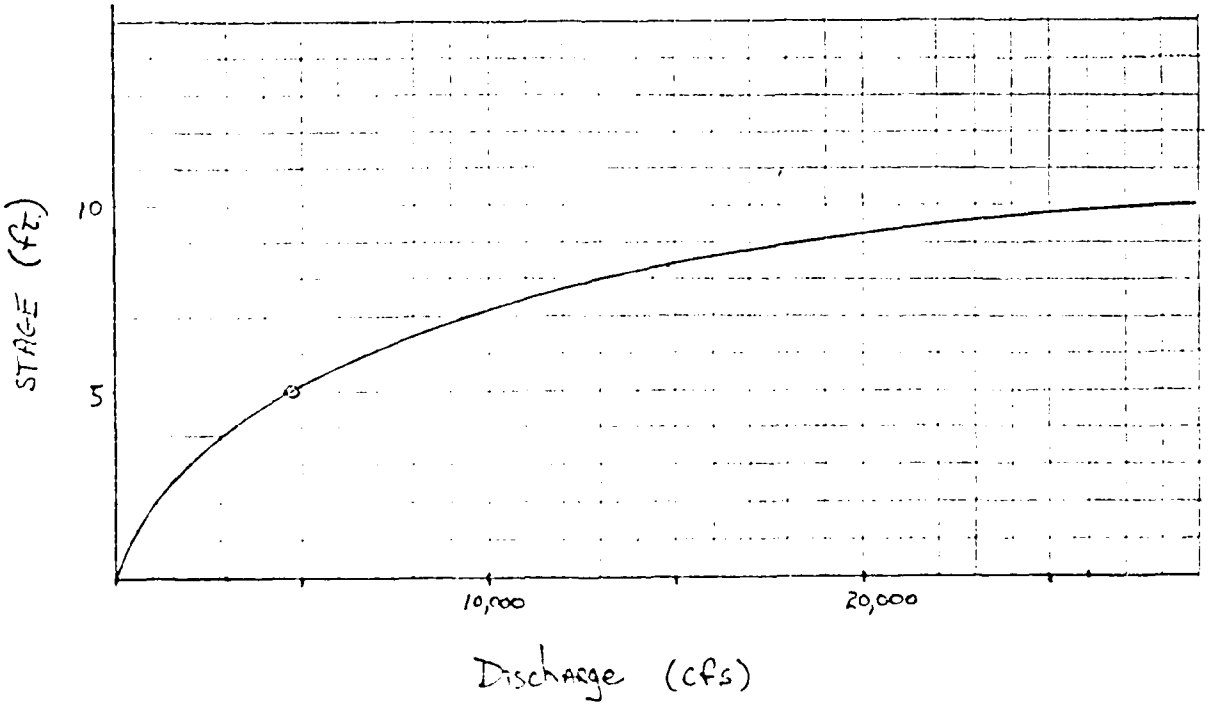
Assume $y = 10'$

$A = 15y^2 = 1500$ s.f. W.P. $= 30.1y = 301$ ft

$R = 0.498y = 4.98$

$$Q = \frac{1.486}{0.03} \times 1500 (4.98)^{2/3} (0.02)^{1/2}$$

$Q = 30{,}806$ c.f.s.



REVISED BY: OHD

Flow thru Culvert

Inlet loss = $0.9\ v^2/2g$

Outlet loss = $1.0\ v^2/2g$

Pipe loss = $0.2\ v^2/2g$ $\left(h_L = f\frac{L}{d}\frac{v^2}{2g}\right)$ where $f = 0.02$, $L = 30'$ & $d = 4'$

$H = 2.1\ v^2/2g$

For $H = 4'$, $V = 11.1$ fps $Q = 140$ c.f.s. (Assume no surcharge)

Flow over East Otis Road

$Q = 12,300 - 140 = 12,160$ cfs

Broad crested weir flow over road:

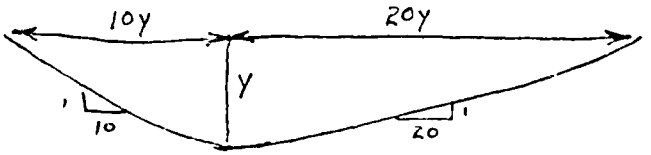
$$H = \left(\frac{Q}{3.0L}\right)^{2/3}$$

$$H = \left(\frac{12,160}{229.5(3)}\right)^{2/3} = 6.8 \text{ ft.}$$ Depth over Road $= \frac{2}{3}(6.8) = 4.6$ ft

∴ The road will be overtopped by approximately 4.6 ft.

3) Compute effect at Route 57, the Section is taken just upstream of Route 57.

Reach = 2200' Culvert = 5.3 ft diameter



Area = $\frac{10y^2}{2} + \frac{20y^2}{2} = 15y^2$

W.P. = $10.14y + 20.02y = 30.1y$

S = 2%

$R = A/W.P. = \frac{15y^2}{30.1y} = 0.498y$

$n = 0.03$

Channel Vol. = Reach x Area

for Q_{p_1} = 12,500 c.f.s.

from graph on pp. 12 y = 8.1 ft

$$Vol = (1500')\left(\frac{13.5(8.1)^2}{43{,}560}\right) - 1.5 = 29 \text{ ac. ft}$$

(See page D-33)

S = 2,000 Acre Feet

$$Q_{p_2}(\text{TRIAL}) = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$$

$$= 12{,}500\left(1 - \frac{29}{2{,}000}\right)$$

$Q_{p_2}(\text{TRIAL})$ = 12,300 c.f.s.

Using $Q_{p_2}(\text{TRIAL})$ = 12,300 c.f.s.

from graph on pp. 12 y = 8.0 ft.

$$V_2 = (1500')\left(\frac{13.5(8.0)^2}{43{,}560}\right) - 1.5 = 28 \text{ ac. ft.}$$

V_2 = 28 Ac-ft

$$V_{AVG} = \frac{V_1 + V_2}{2} = \frac{29+28}{2} = 28.5$$

$$\therefore \quad Q_{p_2} = Q_{p_1}\left(1 - \frac{V_{AVG.}}{S}\right)$$

$$= 12{,}500\left(1 - \frac{28.5}{2{,}000}\right) = 12{,}300 \text{ cfs}$$

Q_{p_2} = 12,300 c.f.s.

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

Assume $y = 10'$

$A = 13.5y^2 = 1,350$ s.f. W.P. $= 27.1y = 271$

$R = .498y = 4.98$

$Q = \frac{1.486}{0.03}(1,350)(4.98)^{2/3}(0.02)^{1/2}$

$Q = 27,624$ c.f.s.

Assume $y = 15$

$A = 13.5y^2 = 3,037.5$ s.f. W.P. $= 27.1y = 406.5$

$R = .498y = 7.47$

$Q = \frac{1.486}{0.03}(3,037.5)(7.47)^{2/3}(0.02)^{1/2}$

$Q = 81,670$ c.f.s.

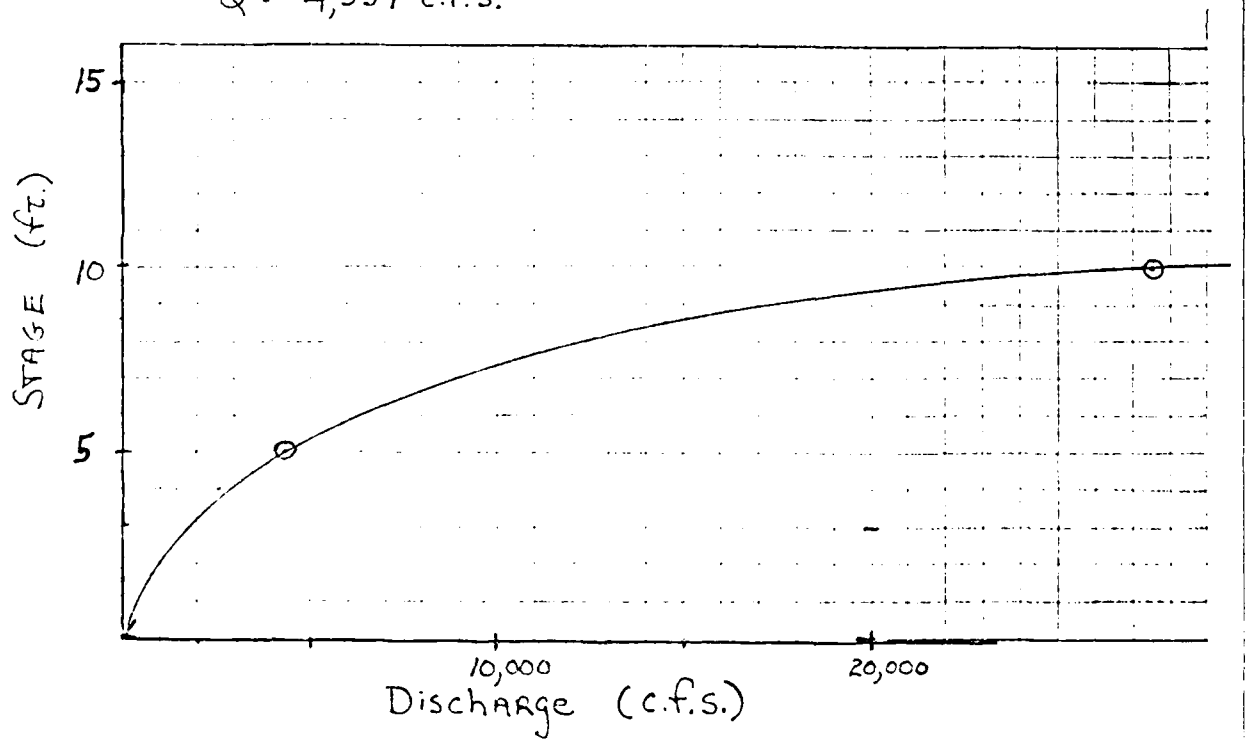
Assume $y = 5$

$A = 13.5y^2 = 337.5$ s.f. W.P. $= 27.1y = 135.5$

$R = 0.498y = 2.49$

$Q = \frac{1.486}{0.03}(337.5)(2.49)^{2/3}(0.02)^{1/2}$

$Q = 4,337$ c.f.s.



Dam Failure Analysis – Twining Pond Dam

$$Q_{P_1} = 8/27\ W_b \sqrt{g}\ Y_o^{3/2}$$

where W_b = Breach Width (40% of dam length @ Mid height)

Y_o = Total height from River Bed to Pool Level @ failure

Q_{P_1} = Peak Failure Outflow

g = 32.2 ft/sec.

W_b = 160 ft × 40% = 64 ft.

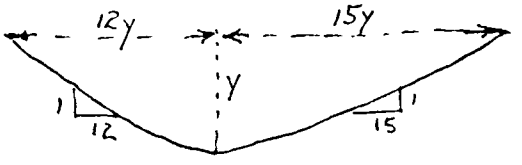
Y_o = 23.8 ft (27 ft – 3.2 ft freeboard)

$$Q_{P_1} = 8/27 \times 64 \times \sqrt{32.2} \times 23.8^{3/2}$$
$$= 8/27 \times 64 \times 5.675 \times 23.8^{3/2}$$
$$Q_{P_1} = 12{,}500 \text{ c.f.s}$$

Note: See page D-33 for analysis prior to dam failure

② Compute effect at First Section – Intersection of discharge stream and East Ohs Road – (48" culvert - boiler plate) Section taken just upstream of East Ohs Road.

Reach = 1500' Culvert = 48"ϕ, 30' long Freeboard = 1 ft.



$$\text{Area} = \frac{15y^2}{2} + \frac{12y^2}{2} = 13.5y^2$$

$$W.P. = 15.03y + 12.04y = 27.1y$$

S = 2% $R = A/W.P. = \frac{13.5y^2}{27.1y} = 0.498y$

$n = 0.03$

$Q_{P3} = Q_{P1}\left(1 - \frac{STOR_{AVG.}}{19}\right) = 1{,}390\left(1 - \frac{6.1}{19}\right) = 944$ c.f.s.

Surcharge height for Q_{P3} is Elev. 1352.3 (from graph on Pp. 7)

Surface Area @ Elev 1352.3 = 124 Acres

Volume of Surcharge Storage = $\frac{100+124}{2}(3.3) = 370$ Ac-ft.

Runoff = $\frac{370}{781} = 0.47$ ft = 5.7 inches

Avg. Stor. = $\frac{6.1+5.7}{2} = 5.9$ inches

$Q_{P4} = Q_{P1}\left(1 - \frac{STOR_{AVG}}{19}\right) = 1{,}390\left(1 - \frac{5.9}{19}\right) = 958$ Ac-ft

Surcharge height for Q_{P4} is Elev. 1352.3 (from graph on Pp. 7)

Surface Area @ Elev. 1352.3 = 124 Acres

Volume of Surcharge = $\frac{100+124}{2}(3.3) = 370$ Ac-ft

Runoff = $\frac{370}{781} = 0.47$ ft = 5.7 inches

Avg. Stor = $\frac{5.9+5.7}{2} = 5.8$ inches

$\therefore$ H = 3.3 ft above normal pool elevation or Elev. 1352.3

Q = 960 c.f.s.

The Spillways can handle the Test Flood of ½ PMF with a depth of approximately 1.8 ft at the control section (assuming the Test Flood was not routed) or a depth of approximately 1.3 ft at the control section (assuming the Test Flood was routed) This would be the elevation at <u>both</u> the Twining Pond Spillway and the Northern Spillway because we assumed both would operate simultaneously.

Reservoir Routing

Normal Pool Elev. = 1349

Height to pass 1,390 cfs (½ PMF) = 1352.8 feet (from graph on Pp. 7)

This is 3.8 ft over Normal Pool Elevation

Surface Area at Elevation 1352.8

From graph on Pp 1 – Area is 130 Acres

Surface Area at Elevation 1349 is 100 Acres

Volume of Surcharge Storage = $\left(\frac{130+100}{2}\right)(3.8)$ = 437 Acre-ft.

Drainage Area = 1.22 sq. mi. = 781 Acres

$$\text{Runoff} = \frac{\text{Storage}}{\text{Drainage Area}} = \text{Stor}_1 = \frac{437 \text{ Ac-ft}}{781 \text{ Ac}} = 0.56' = 6.7 \text{ inches}$$

$$Q_{P_2} = Q_{P_1}\left(1 - \frac{\text{Stor}_1}{19}\right) = 1{,}390\left(1 - \frac{6.7}{19}\right) = 900 \text{ c.f.s.}$$

Surcharge height for Q_{P_2} is Elev. 1352.2 (from graph on Pp. 7)

Surface Area @ Elev. 1352.2 = 123 Acres

$$\text{Runoff} = \frac{\text{Storage}}{\text{D.A.}} = \frac{\left(\frac{100+123}{2}\right)(3.2)}{781} = 0.46 \text{ ft} = 5.5 \text{ inches}$$

Stor_2 = 5.5 inches

$$\text{Avg. Stor} = \frac{\text{Stor}_1 + \text{Stor}_2}{2} = \frac{6.7 + 5.5}{2} = \underline{6.1 \text{ inches}}$$

Spillway Rating (Cont.)

Sample Calculations

Rectangular Weir $Q = 3.33 (L - 0.2H) H^{1.5}$

Orifice $Q = C A \sqrt{2gH}$ $C = 0.65$

1) Compute Flow thru Primary Spillways.

Twining Pond – 2 – 2'x10' Rectangular openings (one each side)

Northerly – 1 – 1'x3' Rectangular opening at upstream face of structure

Assume Rectangular Weirs to top of opening then compute as an orifice.

H	Twining Pond Q	x 2 openings	Total Q	Northerly Q
1	36	2	72 c.f.s.	9.3 c.f.s.
2	91	2	182	22
3	181	2	362	27
4	209	2	418	31
5	233	2	466	35
6	256	2	512	38
6.5	266	2	532	40

2) Compute Flow thru Pipes

Twining Pond – Normal Pond Elev 1349, ℄ Pipe 1334.5, 36" ϕ Pipe @ S=2.9%/100 L=136'
Northerly – Normal Pond Elev. 1349, ℄ Pipe 1346.6, 10" ϕ Pipe @ S=10%/100 L=122'

Darcy Equation: $h_L = f \frac{l}{d} \frac{V^2}{2g}$ where $f = 0.02$ (from Moody Diagram)

Head Losses: Inlet Losses $= 0.5 \frac{V^2}{2g}$ Outlet Losses $= 1.0 \frac{V^2}{2g}$

∴@ Twining Pond: $H = 0.5 \frac{V^2}{2g} + 1.0 \frac{V^2}{2g} + 0.9 \frac{V^2}{2g} = 2.4 \frac{V^2}{2g}$ (H varies from 14.5' to 21')

@ Northerly: $H = 0.5 \frac{V^2}{2g} + 1.0 \frac{V^2}{2g} + 2.9 \frac{V^2}{2g} = 4.4 \frac{V^2}{2g}$ (H varies from 2.4' to 8.9')

3) Compute Flow thru Spillways

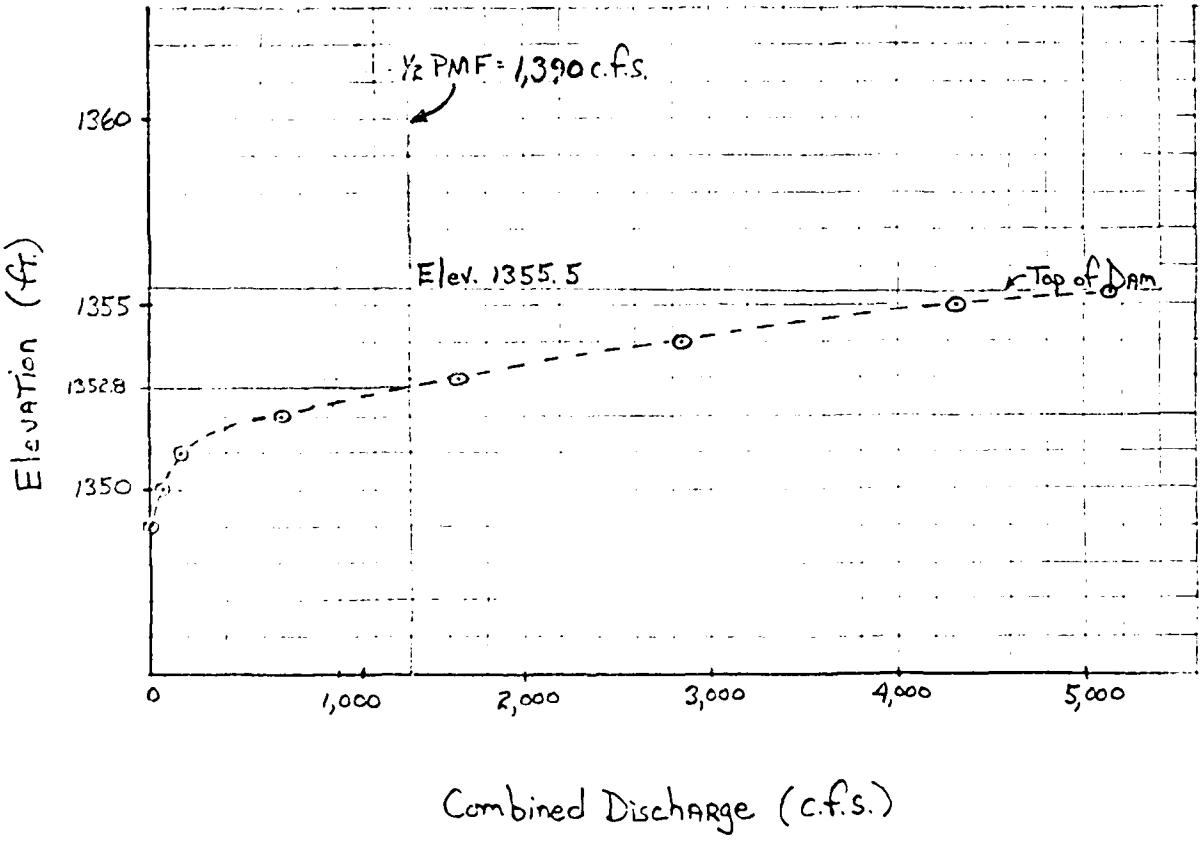
Assume Broad Crested Weirs for each Emergency Spillway

$Q = C L H^{3/2}$ where $C = 2.6$
$L = 170'$
$L = 30'$

Spillway Rating (Cont.)

Combined Stage - Discharge

Elev	Combined Discharge (Twining Pond & Northerly)
1349	0 c.f.s.
1350	81 c.f.s
1351	176 c.f.s.
1352	696 c.f.s.
1353	1,646 c.f.s.
1354	2,877 c.f.s.
1355	4,336 c.f.s.
1355.5 (Top of Dam)	5,140 c.f.s.



Spillway Rating (Cont.)

Stage-Discharge See pp. 8 for sample calculations

@ Twining Pond Dam

Elev.	Spillway Q_1	Emergency Spillway Q_2	Total
1349	0 c.f.s.	0 c.f.s	0 c.f.s.
1350	72 "	0 "	72 c.f.s.
1351	165 "	0 "	165 c.f.s.
1352	165 "	442 "	607 c.f.s.
1353	165 "	1,250 "	1,415 c.f.s.
1354	165 "	2,296 "	2,461 c.f.s.
1355	165 "	3,536 "	3,701 c.f.s
1355.5	165 "	4,219 "	4,384 c.f.s.

@ Northern Dam

1349	0 c.f.s	0 c.f.s.	0 c.f.s
1350	9 "	0 "	9 c.f.s.
1351	11 "	0 "	11 c.f.s
1352	11 "	78 "	89 c.f.s.
1353	11 "	220 "	231 c.f.s.
1354	11 "	405 "	416 c.f.s.
1355	11 "	624 "	635 c.f.s.
1355.5	11 "	745 "	756 c.f.s.

Spillway Rating (cont.)

From curve on pg. 4 Max. Probable Flood for D.A. of 1.22 sq. mi. = 2,280 c.f.s.

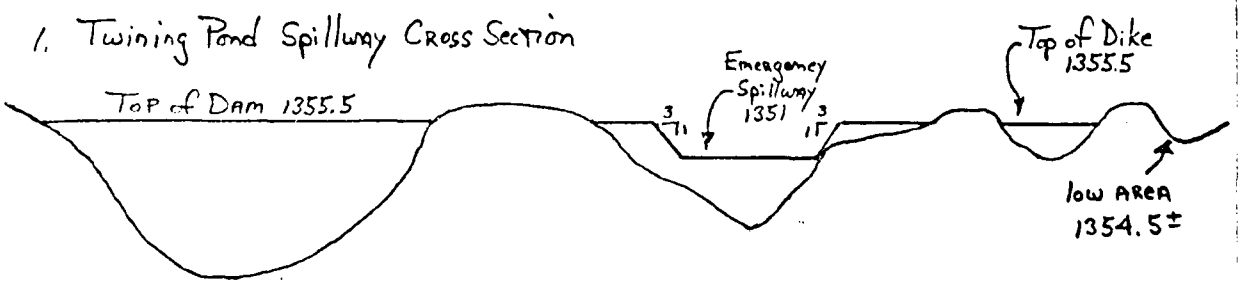
$\therefore$ 1/2 PMF = 2,280 ÷ 2 = 1,140 c.f.s / sq. mi

1,140 × 1.22 = **1,390 c.f.s**

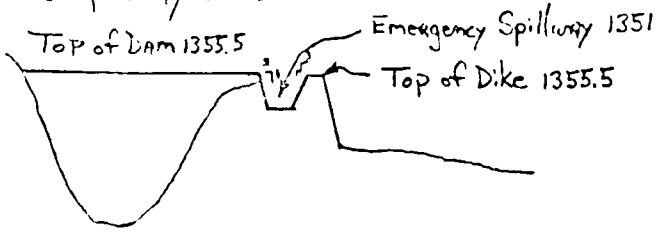
There are two dams on Lost Wilderness Lake (formerly Twining Pond.). The Twining Pond Dam is located at the southwest corner of the lake and is comprised of the dam (27 ft high), emergency spillway (grass 170'± wide), small dikes and a riser type principal spillway (2' × 10' opening). The Northern Dam is located at the northwest corner of the lake and is approx. 23 feet high with an emergency spillway (grass, 30'± wide), a dike (approx 400 ft long, 8'± high) and a riser type principal spillway (3' × 1' opening).

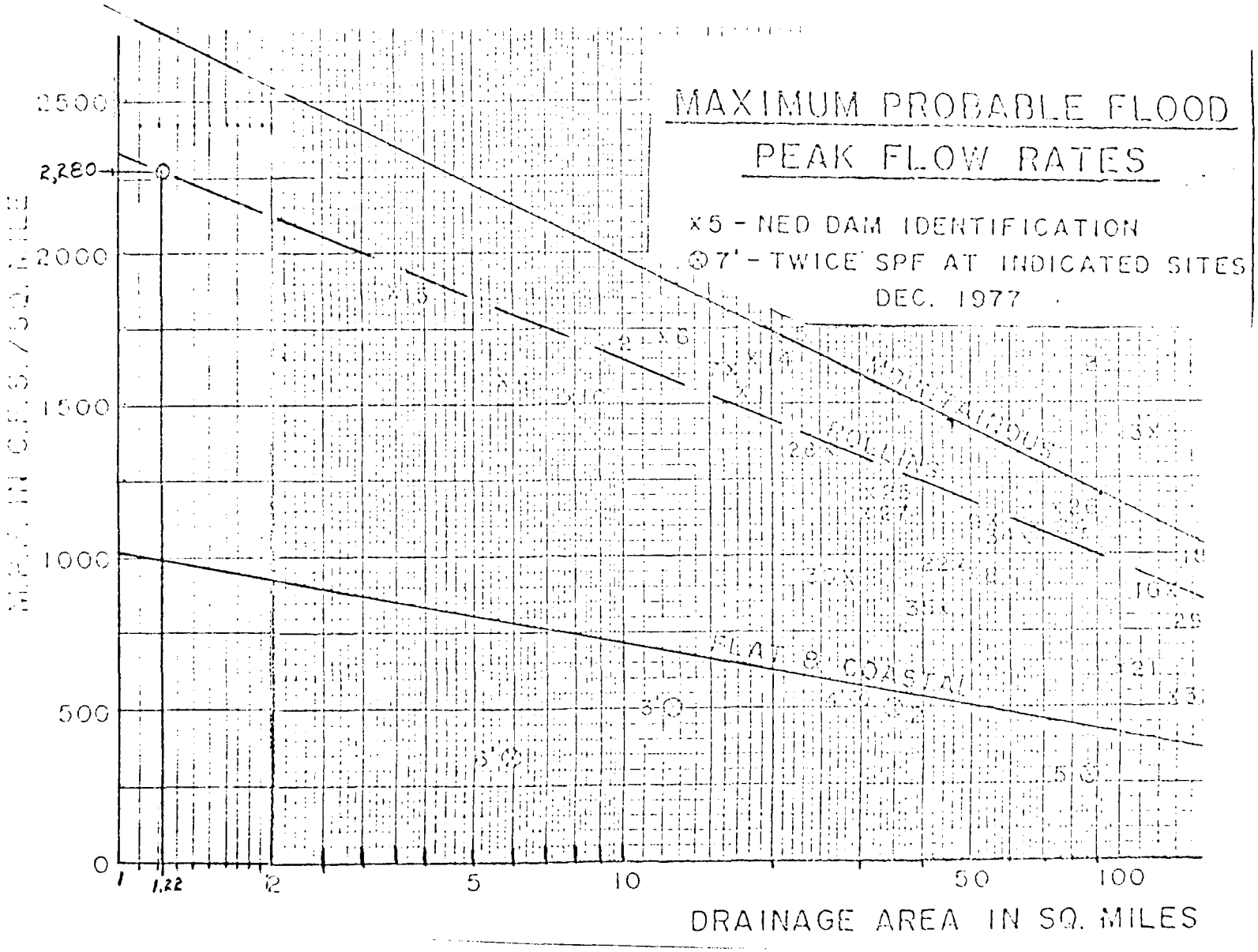
For these calculations we are assuming that the Test Flood will flow through both the Twining Pond spillway and the Northern spillway.

1. Twining Pond Spillway Cross Section



2. Northern Spillway Cross Section




MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊛7' - TWICE SPF AT INDICATED SITES
DEC. 1977
MAXIMUM IN C.F.S. / SQ. MILE
2500
2,280
2000
1500
1000
500
0
1
1.22
2
5
10
50
100
DRAINAGE AREA IN SQ. MILES
MOUNTAINOUS
POLAR
FLAT & COASTAL

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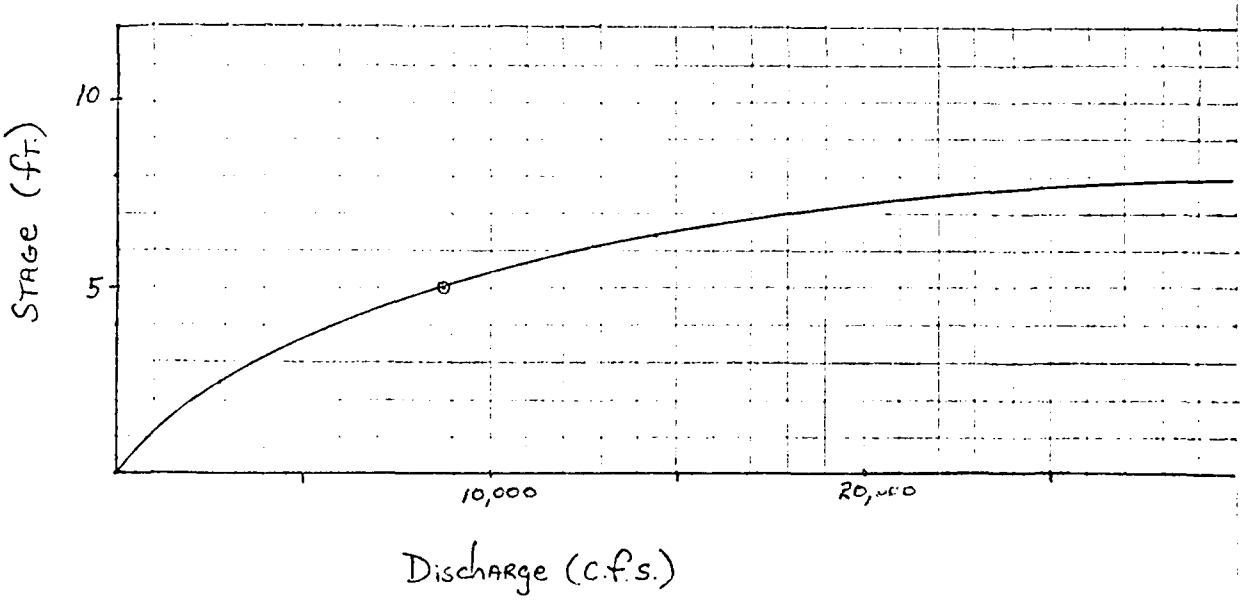
Assume $y = 8'$

$A = 10y^2 = 640$ s.f. $\quad W.P. = 20.1y = 160.8$ ft

$R = 0.498y = 3.98$

$Q = \frac{1.486}{0.03}(640)(3.98)^{2/3}(0.15)^{1/2}$

$Q = 30,977$ c.f.s.



Channel Vol = Reach x Area

for $Q_{P_1} = 12,000$ cfs from above graph $y = 5.9$ ft

$Vol = (2700)\left(\frac{10(5.9)^2}{43,560}\right) - 0.6 = 21$ ac. ft

$S = 2,000$ Acre-feet (See page D-35)

$Q_{P_2}(\text{TRIAL}) = Q_{P_1}\left(1 - \frac{V_1}{S}\right)$

$= 12,000\left(1 - \frac{21}{2000}\right)$

$Q_{P_2}(\text{TRIAL}) = 11,200$ c.f.s.

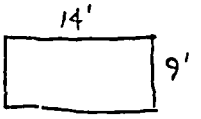
from above graph $y = 5.9$ ft

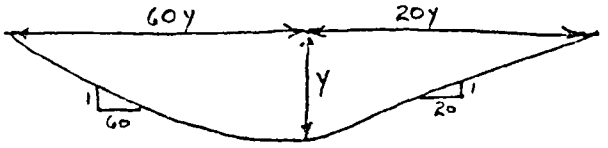
$\therefore \quad Q_{P_2} = Q_{P_2}(\text{TRIAL}) = 11,200$ cfs

5) Section taken just upstream of Route 8

Reach = 900'

Bridge: 60' long





$A_{Rem} = \frac{60y^2}{2} + \frac{20y^2}{2} = 40y^2$

$W.P. = 60.01y + 20.02y \approx 80.1y$

$S = 7\%$

$R = A/W.P. = 40y^2/80.1y = 0.499y$

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ $\quad n = 0.03$

Assume $y = 2$

$A = 40y^2 = 160$ s.f.

$R = 0.499y = 0.998$

$Q = \frac{1.486}{0.03}(160)(0.998)^{2/3}(0.07)^{1/2}$

$Q = 2094$ c.f.s.

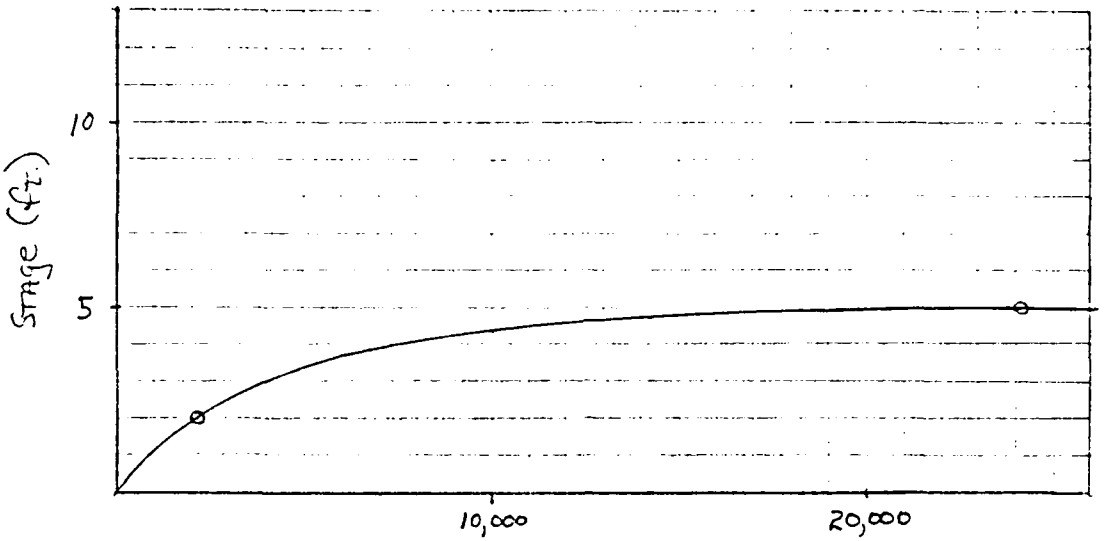
Assume $y = 5$

$A = 40y^2 = 1000$ s.f.

$R = 0.499y = 2.495$

$Q = \frac{1.486}{0.03}(1000)(2.495)^{2/3}(0.07)$

$Q = 24,182$ cfs.



Channel Vol = Reach x Area

for Q_{p_1} = 11900 cfs from above graph y = 4.6 ft

$$Vol = (900')\left(\frac{40(4.6)^2}{43{,}560}\right) - 0.8 = 17 \text{ ac. ft.}$$

(SEE PAGE D-35)

S = 2,000 Acre-Feet

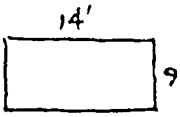
$$Q_{p_2}(\text{TRIAL}) = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$$

$$= 11{,}900\left(1 - \frac{17}{2000}\right) = 11{,}800 \text{ cfs.}$$

Q_{p_2} (TRIAL) = 11,800 c.f.s y = 4.6 ft

$\therefore\ Q_{p_2} = Q_{p_2}(\text{TRIAL}) = 11{,}800$ c.f.s.

Flow thru box culvert @ Route 8



$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$Q = \frac{1.486}{0.03}(126)(3.9)^{2/3}(0.07)^{1/2}$$

Q = 4,110 cfs (assuming no surcharge)

Box culvert can't handle the flow from the failure of Twining Pond Dam, therefore Route 8 will be overtopped.

Flow over Route 8.

$Q = 11,800 - 4110 = 7690$ cfs.

Broad crested weir flow over road:

$$H = \left(\frac{7690}{(352)(3)}\right)^{2/3} = 3.8 \text{ ft.}$$

Depth over Road = $\frac{2}{3}(3.8) = 2.5$ ft.

∴ Route 8 will be overtopped by approximately 2.5 ft.

6) Effect at confluence of the West Branch of the Farmington River

The West Branch of the Farmington River downstream of the confluence with the Twining Pond Dam failure flow is a broad floodplain area which will quickly attenuate the dam failure flow. In addition the Colebrook Reservoir flood protection dam is about 28,000 ± ft downstream. No additional structures or roadway crossings are threatened by a dam failure.

Dam Failure Analysis – Northern Dam

$$Q_{P_1} = \frac{8}{27} W_b \sqrt{g} \; Y_o^{3/2}$$

where, W_b = Breach Width (40% of dam length @ Mid height)

Y_o = Total height from River Bed to Pool Level @ Failure

Q_{P_1} = Peak Failure Outflow

g = 32.2 ft./sec.

$W_b = 115 \text{ ft} \times 40\% = 46 \text{ ft}$

$Y_o = 19.8 \text{ ft}$ (23' – 3.2' freeboard)

$$Q_{P_1} = \frac{8}{27} \times 46 \times (32.2)^{1/2} \times (19.8)^{3/2}$$

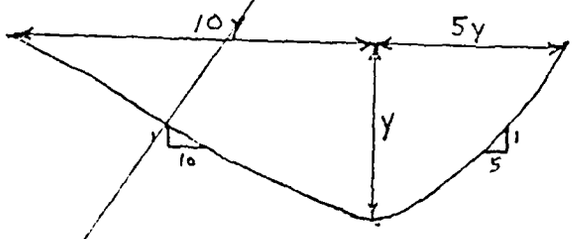
$$= \frac{8}{27} \times 46 \times 5.675 \times 88.1$$

$Q_{P_1} = 6{,}800$ cfs

Note: See page D-36 for analysis prior to dam failure

2) Compute effect at First Section – Intersection of discharge stream and East Otis Road – 30" culvert – boiler plate

Reach = 300 ft Culvert = 30" ϕ, 30 ft. long Freeboard = 1 ft.



$$\text{Area} = \frac{5y^2}{2} + \frac{10y^2}{2} = 7.5y^2$$

W.P. ≈ 15.1y

S = 2% $\quad R = A/\text{W.P.} = \frac{7.5y^2}{15.1y} = 0.497y$

n = 0.03

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

Assume $y = 5'$

$A = 7.5y^2 = 7.5(5)^2 = 187.5$ s.f.

$R = 0.497y = 0.497(5) = 2.485$

$Q = \frac{1.486}{0.03}(187.5)(2.485)^{2/3}(0.02)^{1/2}$

$Q = 2{,}417$ cfs

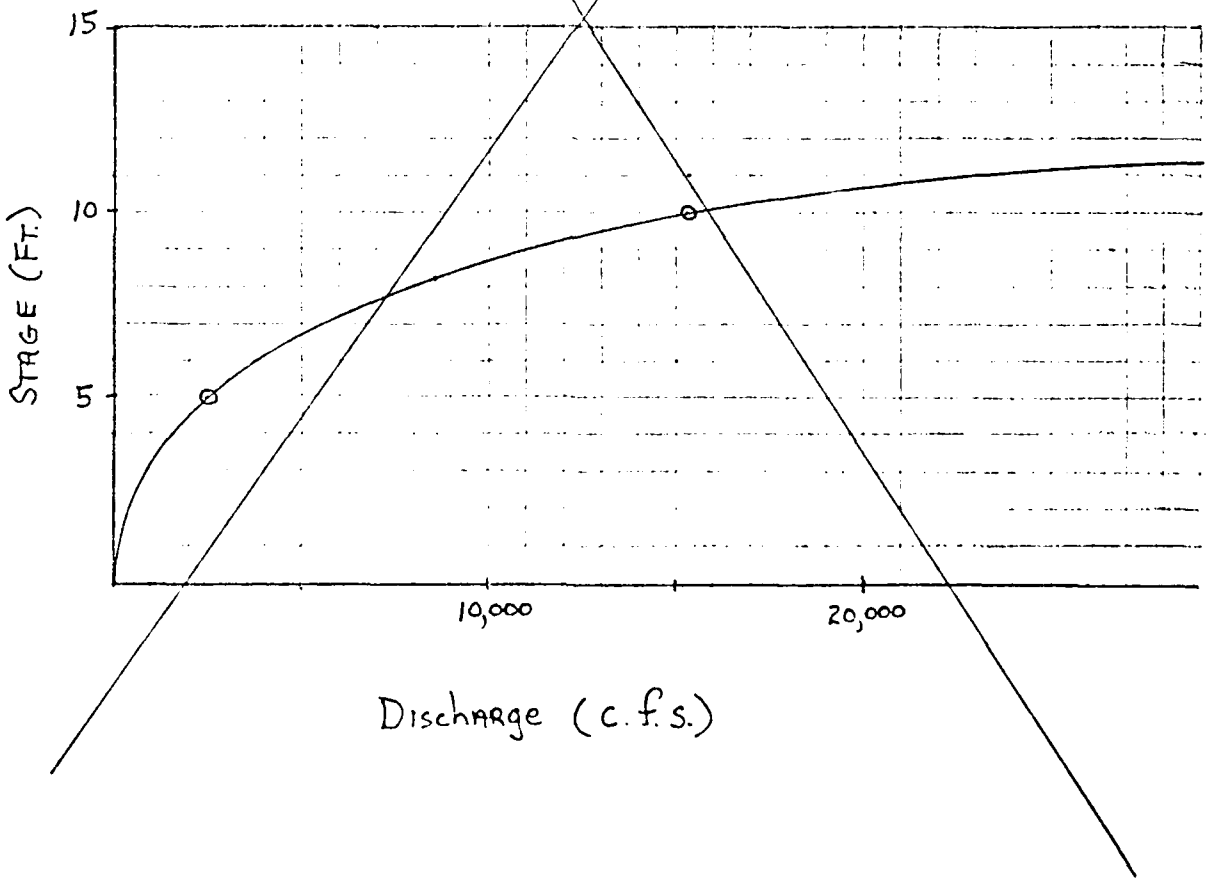
Assume $y = 10'$

$A = 7.5y^2 = 7.5(10)^2 = 750$ s.f.

$R = 0.497y = 0.497(10) = 4.97$

$Q = \frac{1.486}{0.03}(750)(4.97)^{2/3}(0.02)^{1/2}$

$Q = 15{,}383$ c.f.s.



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Channel Vol. = Reach x Area

for Q_{P_1} = 6,800 c.f.s.

from graph on pp. 23 y = 7.6 ft.

Vol = $(300)\left(\frac{7.5(7.6)^2}{43,560}\right)$ = 3 Acre-ft. (prefailure storage negligible)

S = 2,000 Acre-feet

Q_{P_2} (TRIAL) = $6,800\left(1-\frac{3}{2,000}\right)$

Q_{P_2} (TRIAL) = 6790 c.f.s.

Using Q_{P_2} (TRIAL) = 6790 c.f.s.

from graph on pp 23 y = 7.6 ft

Since height remains the same, V_{AVE} = 3 Acre-ft.

and Q_{P_2} = 6790 c.f.s.

Flow thru Culvert

Inlet loss = $0.9\ V^2/2g$

Outlet loss = $1.0\ V^2/2g$

Pipe loss = $0.2\ V^2/2g$ ($h_L = f\frac{L}{d}\frac{V^2}{2g}$) where f = 0.02, L = 30' & d = 2.5'

H = $2.1\ V^2/2g$

For H = 2.5', V = 8.8 fps Q = 43 c.f.s. (Assume no surcharge)

Flow over East Otis Road

Q = 6790 - 43 = 6747 c.f.s

Broad crested weir flow over road:

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$$H = \left(\frac{Q}{3.0L}\right)^{2/3}$$

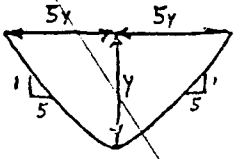
$$H = \left(\frac{6747}{(3.0)(123)}\right)^{2/3}$$

$H = 7.0$ ft. Depth over road $\approx \frac{2}{3}(7.0) = 4.7$ ft.

∴ The road will be overtopped by approximately 4.7 ft.

3) Compute effect at a point 5,000 ft downstream.

Reach = 4,700 ft



$$\text{Area} = \frac{5y^2}{2} + \frac{5y^2}{2} = 5y^2$$

$$\text{W.P.} = 10.1y$$

$S = 8\%$

$$R = A/\text{W.P.} = 5y^2/10.1y = 0.495y$$

$n = 0.03$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

Assume $y = 5'$

$$A = 5y^2 = 125 \text{ s.f.}$$

$$R = 0.495y = 2.475$$

$$Q = \frac{1.486}{0.03} \times 125 (2.475)^{2/3} (0.08)^{1/2}$$

$Q = 3{,}214$ c.f.s.

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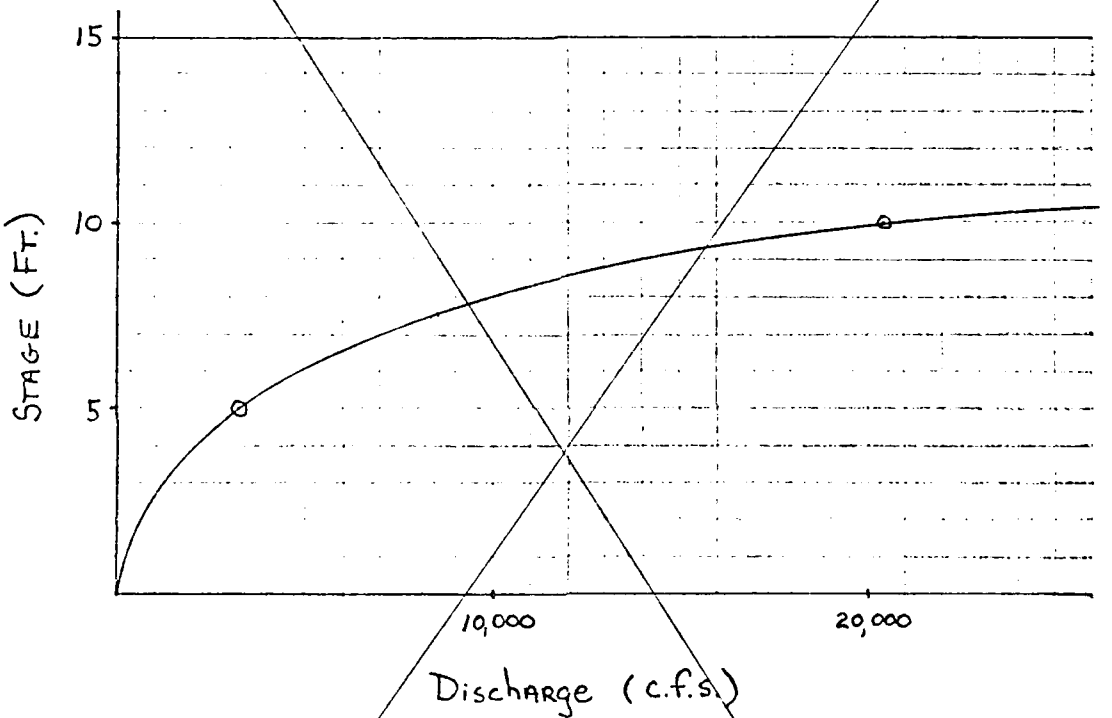
Assume $y = 10'$

$A = 5y^2 = 500$ s.f.

$R = 0.495y = 4.95$

$Q = \frac{1.486}{0.03} \times 500\,(4.95)^{2/3}(0.08)^{1/2}$

$Q = 20{,}455$ c.f.s.



Channel Vol = Reach × Area

for $Q_{P_1} = 6720$ c.f.s.

from above graph, $y = 6.9$ ft

$\text{Vol} = (4{,}700)\left(\frac{5(6.9)^2}{43{,}560}\right) - 0.5 = 25$ ac. ft.

(See page D-36)

$S = 2{,}000$ Acre-ft.

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$$Q_{P_2}\ (\text{TRIAL}) = Q_{P_1}\left(1 - \frac{V_1}{S}\right)$$

$$= 6790\left(1 - \frac{25}{2{,}000}\right)$$

$$Q_{P_2}\ (\text{TRIAL}) = 6700 \text{ c.f.s.}$$

Using Q_{P_2} (TRIAL) = 6700 c.f.s

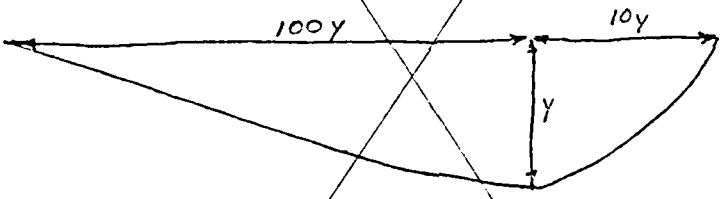
from graph on pp. 26 $y = 7.5$ ft

Since height remains the same, V_{AVG} = 25 Acre-ft.

and Q_{P_2} = 6700 c.f.s.

4) Compute effect at Confluence of the West Branch of the Farmington River

Reach = 1,800 ft.



$$\text{Area} = \frac{100y^2}{2} + \frac{10y^2}{2} = 55y^2$$

$$W.P. \approx 110.1y$$

$S = 3\%$

$$R = A/W.P. = 55y^2/110.1y = 0.5y$$

$n = 0.03$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

Assume $y = 5'$ $A = 55y^2 = 1{,}375$ sf. $R = 0.5y = 2.5$

$$Q = \frac{1.486}{0.03} \times 1{,}375\,(2.5)^{2/3}(0.03)^{1/2}$$

$$Q = 21{,}796 \text{ c.f.s.}$$

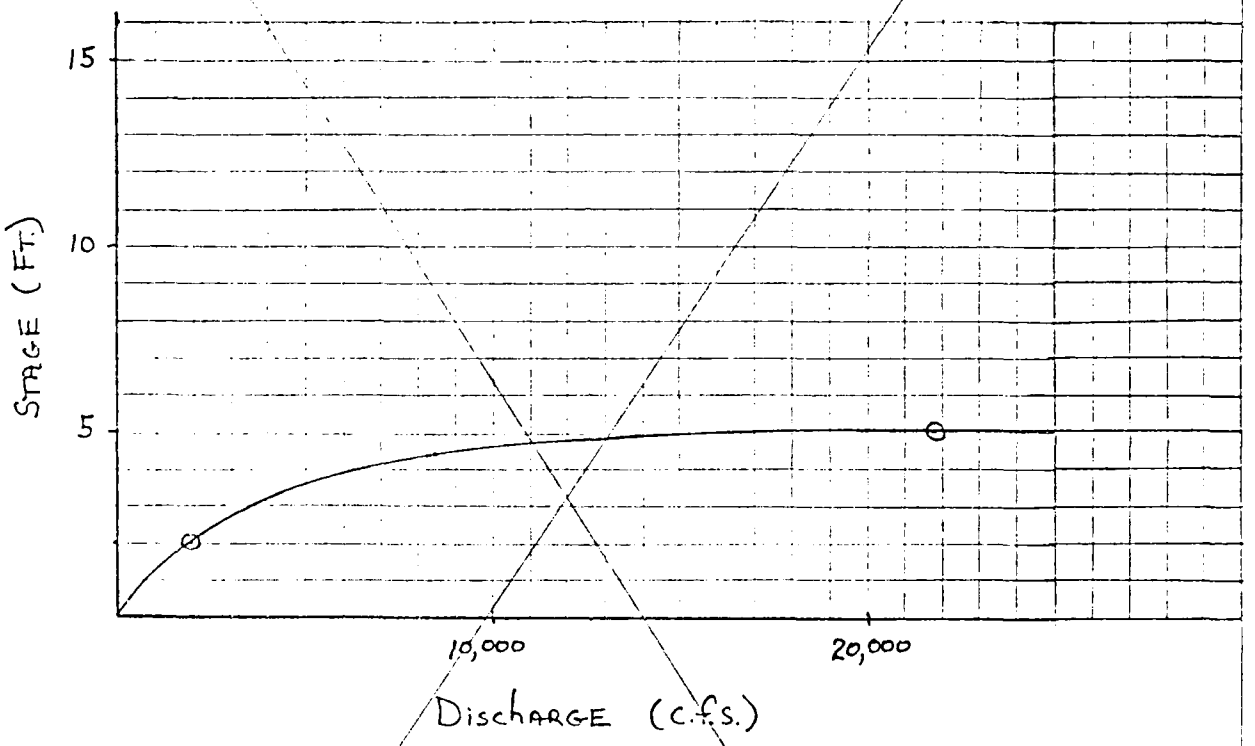
Assume $y = 2'$

$A = 55y^2 = 220$ s.f.

$R = 0.5y = 1$

$Q = \frac{1.486}{0.03} \times 220\,(1)^{2/3}\,(0.03)^{1/2}$

$Q = 1,887$ c.f.s.



Channel Vol. = Reach x Area

for $Q_{p_1} = 6,700$ c.f.s. from above graph $y = 4.1$ ft.

Vol. $= (1,800)\left(\frac{55\,(4.1)^2}{43,560}\right) = 38$ Acre-feet

(prefailure storage is not eligible)

$S = 2,000$ Acre-feet

$Q_{p_2}\,(\text{TRIAL}) = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$

$= 6700\left(1 - \frac{38}{2,000}\right)$

$Q_{p_2}\,(\text{TRIAL}) = 6570$ c.f.s.

Using Q_{P2} (Trial) = 6570 cfs

from graph on page 28, Y = 4.1 ft.

Since height remains the same, V_{ALT} = 38 Ac. ft.

and Q_{P2} = 6570 C.f.s.

Downstream of the confluence with the West Branch of the Farmington River the dam failure flood will be quickly attenuated. No structures, road crossings or other development is threatened by a dam failure.

Analysis of Flow Prior to Dam Failure - Twining Pond Dam

Routed flow from Twining Pond Dam ≈ 800 c.f.s.
Routed flow from Northern Dam ≈ 160 c.f.s.
960 c.f.s. total routed flow

2) Compute effect at the intersection of discharge stream and East Otis Road

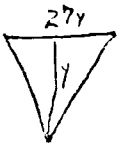
Flow prior to dam failure = 800 c.f.s.

From graph on page 12, stage = 1.8 feet

Flow over East Otis Road (see page 14)

$Q = 800 \text{ c.f.s.} - 140 \text{ c.f.s.} = 660 \text{ c.f.s.}$

from graph on page 12, @ $Q = 660$ c.f.s., $h = 1.7$ ft.



$y = 1.7$
$2.7y = 45.9$

$$H = \left(\frac{Q}{3.0\,L}\right)^{2/3}$$

$$H = \left(\frac{660}{(3.0)(45.9)}\right)^{2/3} = 2.8 \text{ ft}$$

Depth over road ≈ $\frac{2}{3}(2.8) = 1.9$ ft

∴ The road will be overtopped by approximately 1.9 feet

Storage Volume = $1500 \left(\frac{13.5\,(1.8)^2}{43{,}560}\right) = 1.5$ ac. ft.

3) Compute effect at Route 57

Flow prior to dam failure = 800 c.f.s.

From graph on page 15, stage = 1.8 feet

Flow over State Road 57 (see page 17)

Q = 800 c.f.s. - 280 c.f.s. = 520 c.f.s.

From graph on page 15, y = 1.3 feet

@ y = 1.3 L = 30y = 39 ft.

$$H = \left(\frac{520}{(39)(3.0)}\right)^{2/3}$$

H = 2.7 ft.

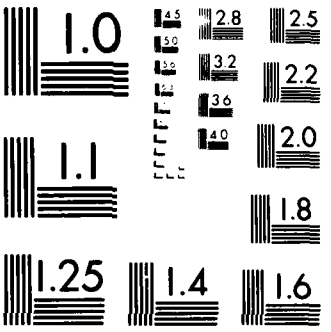
Depth over road = 2/3 (2.7) = 1.8

∴ The road will be overtopped by approximately 1.8 feet

$$\text{Storage Vol} = 2200\,\frac{(15)(1.3)^2}{43{,}560} = 1.3 \text{ ac. ft.}$$

AD-A154 535 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
LOST WILDERNESS LAKE.. (U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV DEC 79

UNCLASSIFIED F/G 13/13 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

4) Compute effect approximately 900 ft. ± upstream of Route 8

Flow prior to dam failure = 800 c.f.s.

From graph on page 18, stage = 1.0 feet

$$\text{Storage Vol} = 2700 \left(\frac{10(1.0)^2}{43,560}\right) = 0.6 \text{ ac. ft.}$$

5. Compute effect just upstream of Route 8

Flow prior to dam failure = 800 cfs.

From graph pgs. 20 (D-23), stage = 1.0 ft

$$\text{Storage Vol} = 900 \frac{(40(1.0)^2)}{43,560} = 0.8 \text{ ac. ft.}$$

Analysis of Flow Prior to Dam Failure: Northern Dam

Routed flow from Northern Dam = 160 CFS

2) Compute effect at intersection of discharge stream and East Otis Road.

Flow prior to failure = 160 CFS
from graph page. 23 (D-26), stage = 1.0 ft

Flow over East Otis Road:

$Q = 160 \text{ cfs} - 43 \text{ cfs} = 117 \text{ cfs}$.

$$H = \left(\frac{Q}{(3)(L)}\right)^{2/3} = \left(\frac{117}{(3)(100)}\right)^{2/3} = 0.5 \text{ ft}$$

Depth over road = $\frac{2}{3}(0.5) = 0.3$ ft
Storage Volume is negligible

3) Compute effect at a point 5,000 ft downstream.

Flow prior to failure = 160 CFS.
from graph page. 26 (D-29), stage = 1.0 ft

$$\text{Storage Volume} = 4{,}700\left(\frac{(5)(1.0)^2}{43{,}520}\right) = 0.5 \text{ ac. ft.}$$

4) Compute effect at confluence with West Branch of the Farmington River:

Flow prior to failure = 160 CFS

from graph page 28 (D-31), stage = 0.3 ft

Storage Volume is negligible

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

TWINING POND

Photo 1 - Dam overview looking westerly from left abutment

Photo 2 - Dam overview looking easterly from right abutment

Photo 3 - Principal spillway drop inlet riser structure

Photo 4 - Downstream face of emergency spillway. Note debris along control section and erosion along downstream slope

Photo 5 - Toe of slope at emergency spillway. Note wet area along entire toe of slope

Photo 6 - Plunge pool and discharge channel looking southerly from top of dam. Note that the stilling basin has not been constructed and that the area has not been protected by riprap.

Photo 7 - Discharge of 36" principal spillway pipe. Note spalling at top of pipe.

Photo 8 - Discharge of 36" principal spillway. Note that toe drains are completely covered by grass.

Photo 9 - Discharge of left toe drain pipe

Photo 10 - Discharge of right toe drain pipe

Photo 11 - Toe of slope of dam looking westerly from left abutment

Photo 1 - Dam overview looking westerly from dike. Note debris at entrance to the emergency spillway.

Photo 2 - Dike overview looking northerly from left abutment of dam. Note drop inlet principal spillway structure.

Photo 3 - Entrance to emergency spillway looking easterly from right side of embankment. Note debris and rock outcrop.

Photo 4 - Dam overview looking easterly from downstream slope of emergency spillway. Note tracks on downstream face of embankment.

Photo 5 - Close-up of tracks on downstream face of embankment. Note additional erosion

Photo 6 - Headwall for 10-inch principal spillway pipe and toe drain, looking easterly from downstream channel.

Photo 7 - Overview of discharge channel and downstream conditions. Looking westerly from downstream slope of embankment.

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
MA	321	NED	MA	013	01				LOST WILDERNESS LAKE SOUTHERN DAM	4205.8	7303.4			

(12) POPULAR NAME	(13) NAME OF IMPOUNDMENT
TWINING POND MAIN DAM	LOST WILDERNESS LAKE

(14) REGION	(15) BASIN	(16) RIVER OR STREAM	(17) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(18) DIST FROM DAM (MI.)	(19) POPULATION
01	08	TR-FARMINGTON RIVER WEST BRANC TOLLAND			

(20) TYP. OF DAM	(21) YEAR COMPLETED	(22) PURPOSES	(23) STRUCTURAL HEIGHT (FT.)	(24) HYDRAULIC HEIGHT (FT.)	(25) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(26) NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
PGRE	1976	R	27	27	2000	1200	NED	N	N	N	N	

(27) REMARKS
14-SECOND DAM ON SAME IMPOUNDMENT. -MA01059

(28) D/S HAS	(29) SPILLWAY CREST LENGTH	(30) TYPE	(31) WIDTH (FT.)	(32) MAXIMUM DISCHARGE (FT.)	(33) VOLUME OF DAM (CY)	(34) POWER CAPACITY INSTALLED (MW)	(35) PROPOSED (MW)	(36) NAVIGATION LOCKS NO.	(37) LENGTH (FT.)	(38) WIDTH (FT.)	(39) LENGTH (FT.)	(40) WIDTH (FT.)	(41) LENGTH (FT.)	(42) WIDTH (FT.)	(43) LENGTH (FT.)	(44) WIDTH (FT.)
2	440	U	170	4200												

(45) ENGINEER

(46) CONSTRUCTOR

END

FILMED

7-85

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